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MAY 2005

MODEL Airplane NEWS

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MAY 2005 VOLUME 133 NUMBER 5

ON THE COVER: Great Planes' Super Chipmunk is captured in flight by John Reid. See the review by Robert Reid on page 30.
ON THIS PAGE: Peter Abbe reviews BME Aircraft's 27% Pitts Challenger (page 54; photos by Peter Abbe & Cheri Sassman).

Precision control

COMPUTER RADIOS, FLIGHT-STABILIZATION UNITS, ONBOARD MONITORS ... these technological advances make it easy for our airplanes to fly better than ever. But unless you fly competitively, you may not have thought much about digital servos. This month, our "Digital Servos" feature takes an inside look at how these little powerhouses work and the many advantages they offer over standard servos. In addition to their precision control, incredible holding power and superfast response time, they offer more torque in a smaller package. Check them out and see how the right gear can make all the difference to your plane's performance.

Flight simulators are another of our technological assets: now we can fly anywhere, anytime, and attempt any maneuver without risking our planes (or our egos!). This month, we test the newest sim to hit the market: the Aerofly Professional Deluxe from Ikarus. With more than 50 planes and helicopters, great graphics and realistic flight performance, this sim has something for everyone. Check out our complete review on page 82.

Small details can make all the difference between a nice scale airplane and one that ends up in the winners' circle. The next time you're building a fighter, trainer, or homebuilt model of a plane that has a sliding canopy, why not incorporate one into your plane? Building a functional sliding canopy is easier than you may think; turn to our "Scale Techniques" column on page 98, and get started.

Master modeler Rich Uravitch has designed many of *Model Airplane News*' most popular plans, including his well-known Extra 3.25, A-7 Corsair and OV-10 Bronco. This month, we're pleased to offer another Rich Uravitch original: the 48-inch-span electric MiniWave. This 4-channel, electric ducted-fan jet is an easy build that features traditional construction. It isn't for the faint of heart, however; in the air, it can reach speeds of up to 100mph! If you want to be the first to show up at your field with a MiniWave, start building one today; like all of Rich's designs, this one is destined to be a classic. Check it out on page 125.

As this issue went to press, we were saddened to learn of the death of Hal "Pappy" deBolt. A true pioneer of RC, Hal contributed articles to *Model Airplane News* from the early '50s, including his popular "Golden Age of R/C" column, and his enthusiasm and zest for model airplanes were a driving force throughout his life. We were honored to call him our friend, and we'll miss him dearly.

Debra Cleghorn

Executive Editor

MODEL Airplane NEWS
Est. 1929

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> **"...I had no idea there were so many variations on this maneuver."**

HUMPTY BUMP

I want to tell you how impressed I was with Dave Patrick's article "ABCs of the Humpty Bump." I had no idea there were so many variations on this maneuver. The illustrations were killer! I hardly had to read the text—but I did anyway. Dave's ability to explain things clearly and point out places where mistakes often occur is of great value to someone like me. Please tell Dave how much we common sport pilots appreciate his articles, and ask him to write more!

PETER MORGAN, WALPOLE, MA

Peter, we are very pleased to have Dave as a contributor. The combination of his knowledge and the great illustrations from FX Models sure add up to great reading! Don't worry; we have articles on other maneuvers in the works.

GY

SCALE PROPS

I just finished reading the February 2005 issue of *Model Airplane News*. My favorite article was the 25th U.S. Scale Masters Championships. The model detail is astonishing! Your article raised a question regarding WW II warbirds that has been on my mind for some time, though: why aren't they flown with scale propellers? For example, I saw the original P-47 "Big Stud" when it was at the Champlin Fighter Museum in Arizona. The photo of Max Ficken's Thunderbolt (p. 30) clearly shows it swinging a wooden 2-blade prop. I often see these planes on static display with scale-looking props. Could you please explain why pilots change to non-scale props when they fly these warbirds? I've always wanted to have my own scale warbird, but it just seems wrong to put a 2-blade prop on a plane that actually used a 3- or 4-blade prop.

MICHAEL PFEIFER

COLORADO SPRINGS, CO

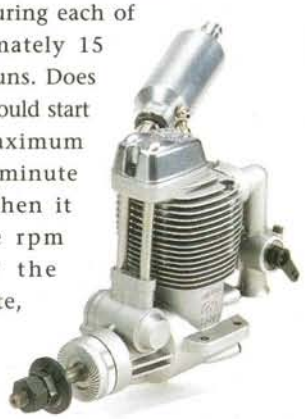
Michael, I'm glad you enjoyed the Scale Masters Championship coverage. For most scale competitions, the contestants are judged

first in Static and then, after all the models have been scored, everyone moves on to the flight portion of the event. During the Static judging, the models are all fitted with the scale propellers and spinners that best match the modeler's scale documentation. If the model has 3 or 4 blades, then the static prop and spinner have to match the scale drawings. The static prop and spinner are then switched to the flying setup and are not scored during flight judging. Most contestants paint their prop blades to match the color of the full-size airplanes, but these sometimes break, so they replace them with common, everyday wood-colored sport props. I suspect that this is what happened to Max's Jug! I hope that clears things up.

GY

ENGINE BREAK-IN CLARIFIED

In reference to your fine review of the O.S. FL .70 engine in the March 2005 issue, I noticed a deviation from suggested break-in procedures. You advised that the engine be close to maximum rpm at startup and then to alternately richen the mixture by 300rpm during each of the approximately 15 two-minute runs. Does this mean I should start at nearly maximum rpm for one minute and then richen it to drop the rpm by 300 for the second minute, or should I run it for two minutes at nearly maximum rpm for one run, have the next engine run set at 300rpm for two minutes and then shut down, cool off and restart?



In addition, does that mean one continuous 30-minute run starting at nearly maximum rpm for two minutes, then 300rpm down for two minutes and then up to near maximum again for two minutes, etc. for 15 cycles or so? I have never broken in an ABC or equivalent engine.

CHARLES W. GREENWOOD
COLUMBUS, IN

Charles, sorry for the confusion; allow me to try again:

Start the engine at approximately ½ throttle (for safety purposes). After you have started the engine, advance the throttle to wide open, and adjust the needle valve to maximum rpm as measured by a tachometer. At that point, richen the needle valve until the rpm drop by about 300 from peak (max). The engine will be operating near its desired operating temperature, and that is necessary for stress-relief heat cycling—the primary reason for break-in of these ABC-type engines in the first place. Run the engine for about two minutes, and then shut it down to cool (it should be cool to the touch). Restart the engine for another two minutes (same procedure). Continue this procedure until you have at least 30 minutes of cumulative run time. That's it! Go fly the engine in your favorite airplane.

DAVE GIERKE

WRITE TO US! WE WELCOME YOUR COMMENTS AND SUGGESTIONS. LETTERS SHOULD BE ADDRESSED TO "AIRWAVES," *MODEL AIRPLANE NEWS*, 100 EAST RIDGE, RIDGEFIELD, CT 06877-4606 USA; EMAIL MAN@AIRAGE.COM. LETTERS MAY BE EDITED FOR CLARITY AND BREVITY. WE REGRET THAT, OWING TO THE TREMENDOUS NUMBERS OF LETTERS WE RECEIVE, WE CANNOT RESPOND TO EVERY ONE.

Illustrations by Richard Thompson

Tool time

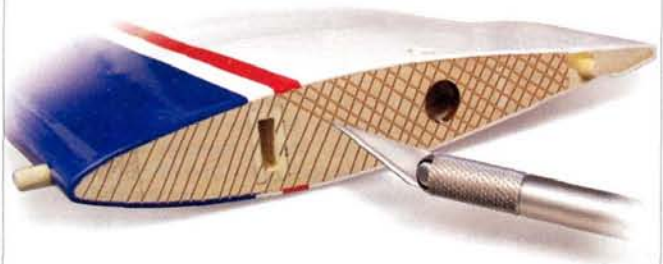
How often during the building of a kit are your tools scattered all over your workbench? If you're like most modelers, it's probably most of the time. Here is an inexpensive answer to that problem. Take an old cigar box and the cardboard tubes from some empty rolls of covering material. Cut the tubes into different lengths, and hot-glue them into the cigar box. Now, all your tools are neat and orderly in one place for quick use.
Carl Malta, Jamestown, NY

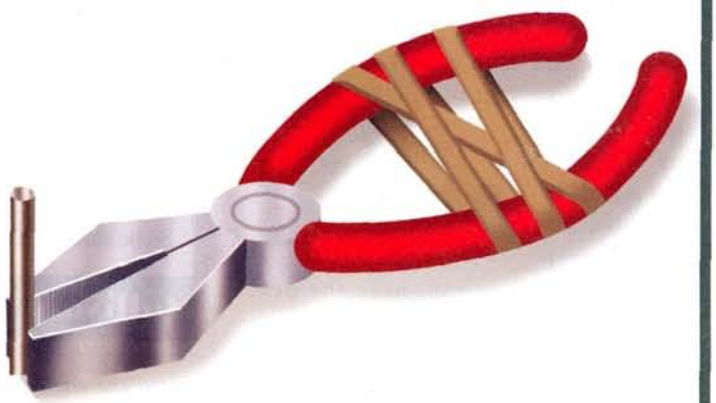
Better engine runs

During the life of an engine, the clicker that prevents the needle valve from rotating during flight can become fatigued because of vibration. To prevent the needle valve from vibrating and changing settings while in flight, place a small O-ring around it and the clicker. You could also use a very thin slice of fuel tubing in place of the O-ring.
Harold Nance, LeSage, WV

Get a grip

To get the best possible bond when gluing wing halves together, lightly score the root ribs in a crosshatch pattern with a sharp modeling knife. Scoring the root ribs in this way allows for more surface area for the epoxy to adhere to, and that provides a tighter, stronger bond. You can also use this technique on other wood-to-wood joints.
Steve Higgins, Muncie, IN





Powerful pliers

You can turn a pair of pliers into a third hand by tightly wrapping a thick rubber band around the handles. The pliers can securely hold small objects, leaving both of your hands free to work. I use this trick all the time when soldering.
Tim Richards, Concord, NC +

SEND IN YOUR IDEAS. *Model Airplane News* will give a free, one-year subscription (or a one-year renewal, if you already subscribe) for each idea used in "Tips & Tricks." Send a rough sketch to *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA. BE SURE THAT YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH ITEM YOU SUBMIT. Because of the number of ideas we receive, we can neither acknowledge each one nor return unused material.

<YP80A "Grey Ghost"

Col. Robert E. Thacker
San Clemente, CA

This 1/5.4-scale "Grey Ghost" "... flies like a bird," says longtime modeler and WW II veteran Col. Robert Thacker, who has a tremendous appreciation for the YP80A since he had the opportunity to fly an experimental version in 1946. His YP80A has a 72-inch wingspan and 936 square inches of wing area, and it weighs 20 pounds. Col. Thacker also included ProMark and Savage markings to put on top of his PPG by Siebring-painted finish. He powers his model with a P-70 Jet Cat engine that packs 15 pounds of thrust.

>1/4-scale Fokker D.VIII

John Ferguson
Red Deer, Alberta, Canada

John made this Balsa USA kit his own by modifying the cowl, fuselage, tail section, landing skid and the entire cockpit! Another modified feature is John's 3-piece wing. For easy transportation, he constructed the wing to disassemble into sections and uses large-scale aluminum joiner tubes to reassemble it once on site. He powers his Fokker D.VIII with a Saito 1.70R 3-cylinder radial engine and a JR 8103 radio system. John explains that his radial engine "... adds a lot of realism in flight, and the model is a hoot to fly!"

<E-Star 120

Charles Gray
Winter Haven, FL

With more than 55 years of modeling under his belt, Charles certainly knew what he was doing when it came to building his E-Star 120. He decided to convert his Sig Four-Star 120 into an electric, so his first step was to lighten the model by cutting holes in almost all of its plywood parts and removing all the parts used for gas engines. He managed to cut the E-Star's weight down to 10 pounds, 13 ounces, and it can fly for up to 30 minutes. He powers his plane with a Hacker C50 13XL motor, 6.7:1 gearbox, 24x12 APC prop and two Thunder Power Li-poly 4S3P 8000mAh batteries. The E-Star 120, according to Charles, "... can do almost any maneuver from hovering to 3D aerobatics."

>Classic Bipe

Graeme Rose
Hastings, New Zealand

Although originally scratch-built from *Model Airplane News* plans, this Classic Bipe came to Graeme as a wreck. You would never know that the nose and fuselage have been entirely rebuilt. The nose was lengthened by 1 inch, and Graeme also added a vented cowl to cool the engine during flight. He powers his model with 6 servos, a U.S. .41 gas engine and Futaba radio gear.

"Horatius" Handley Page .42
Barrie Roberts
Hastings, New Zealand

Barrie scratch-built this massive, 8-foot-wingspan model from his own plans. Weighing only 15 pounds, this "Horatius" is powered by four 600 BB Graupner motors Great Planes ElectriFly gearboxes, 2 10-cell, 2500mAh batteries and 9x6 APC props.

Composite-ARF Extra 330
Dave Stoik
Prunedale, CA

This gorgeous Extra took Dave only 45 hours to assemble! With a wingspan of 118 inches and a weight of 35½ pounds, this Extra needs quite a bit of power to get into the air, and the Desert Aircraft 150cc engine provides it. Dave souped up his model with a set of Dalton Aviation carbon-fiber exhaust canisters, an Emcotec DPSI power box, dual Fromeco 4400mAh 7.4 lithium-ion batteries, 9 JR 8611 servos, 1 Hitec 5925 high-speed digital servo for throttle control, a Fromeco 2100mAh Li-ion battery for ignition, Airmodels' 32x11 propeller and, of course, mid-grade gasoline with a 100:1 Amsoil premixed fuel. Dave's Extra is sure to keep your eyes on the sky!

Goldberg .60 Ultimate biplanes
Chuck Mullenix & Jonathan Blycker
Spokane Valley, WA

These two bipes were created to celebrate the ongoing battle of Coke versus Pepsi. Both models are similarly constructed and outfitted with custom-built bomb bays, but Chuck's Pepsi plane is powered by a Saito 1.20 4-stroke, and Jonathan's Coke model is powered by a Magnum 1.20 4-stroke. Which plane won—Coke or Pepsi? Jonathan writes, "Coke won this cola challenge when the Pepsi plane had a full-throttle grudge match with gravity." Sorry to hear about your model, Chuck, but thanks for sharing.

Richmond RC Harvard II
Jim Meagher
Naperville, IL

Check out all of the high-tech modifications in this ARF! Jim has dressed up his plane with scale lights, a red rotating beacon, dual-wingtip Xenon strobe lights and an LED in the cockpit. He also modified the wing to accept 2 servos instead of the recommended 1 for the model's ailerons. Jim's Harvard II even uses flaperons. He powers his model with a GMS .61 engine and also outfitted the plane with a Slimline Pitts muffler, a Futaba T6XA radio, 7 Hitec RCD servos and a Hydrimax 1450mAh battery pack.

SEND IN YOUR SNAPSHOTS. *Model Airplane News* is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable, but please do not send digital printouts or Polaroid prints. Emailed submissions must be at least 300dpi. We receive so many photographs that we are unable to return them. All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of the year. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in! Send those pictures to "Pilot Projects," *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA.

SPORTSMAN AVIATION
RYAN STA

The Ryan STA is a classic aircraft known for its great handling when modeled. This version, finished in YPT-16 military-version colors, combines classic looks with easy assembly and nice flight characteristics. It features an all-wood, hand-crafted airframe with iron-on covering, a fiberglass cowl, easy-to-install wheel spats as well as wing struts, simulated flying wires, clear windscreens and all the necessary hardware. It requires a .28 to .46 2-stroke or .52 4-stroke engine and a 4-channel radio. Specs: wingspan—57 in.; wing area—488 sq. in.; length—41 in.; weight—60 to 68 oz.; wing loading—17 to 20 oz./sq. ft.

Sportsman Aviation; distributed by Global Hobby Distributors (800) 854-8471; globalhobby.com.

PARKZONE
WILD HORSE P-51D

The most successful fighter of WW II, the P-51D Mustang still thrills thousands today in airshows and air races around the world. Now you can experience Mustang thrills on a smaller scale with this fully aerobatic charge-and-fly reproduction from ParkZone. It comes with a 3-channel FM transmitter, a 9-cell, 1000mAh NiMH battery and a peak-detect charger. Two flight modes allow less experienced pilots to have greater stability and expert pilots to perform high-energy maneuvers such as loops, victory rolls and Cuban-8s. Its receiver is equipped with an X-Port connector, and its receiver/ESC module and two servos can even be removed and used in other electric aircraft. The ParkZone P-51D costs $180.

ParkZone; distributed by Horizon Hobby Inc. (800) 338-4639; horizonhobby.com.

INTERNET-RC
NOVAROSSI ENGINES

Engine enthusiasts have reason to celebrate: Novarossi's well-respected, high-performance line of airplane and helicopter powerplants will now be available in the U.S. from Internet-RC! These competition-grade machines have been manufactured in Italy for the past 40 years and have earned a reputation for offering high rpm and plenty of horsepower, as well as in-flight mixture controls. Check out Internet-RC's website for more details, and stay tuned for an upcoming review of one of these engines.

Internet-RC (602) 347-1600; internet-rc.com.

SPORT FLYERS
WILD WING

Developed for performance sport flying, this EPP-foam electric flying wing is fast and maneuverable, and it has 290 square inches of wing area for superior low-speed control. All of the radio-system slots are molded into the one-piece wing, so it's a super-fast build. And, of course, it's EPP, which means it will take a beating and keep coming back for more. Although the wing can be flown "bare," you can apply the included strapping tape for even more durability. The Wild Wing also features corrugated plastic fins and a vacuum-formed skid; it comes with a motor mount and hardware. Specs: wingspan—35 in.; weight—15 to 18 oz.; wing loading—7.5 to 9 oz./sq. ft.; motor req'd—Speed 400; radio req'd—3-channel w/elevon mixing and 2 servos.

Sport Flyers; distributed by Hobby People (800) 854-8471; hobbypeople.net.

GWS
NEW GWT6A RADIO & RD8SL RECEIVER

GWS has added two more channels to its popular 4-channel Dream Starter transmitter. The new 6-channel version offers a trainer system, servo-reversing on 4 channels, a landing-gear switch and a three-position switch. All GWS transmitters come with a rechargeable NiMH battery and can use FMS (Flying Model Simulator) flight-simulation software.

The new 8-channel RD8SL receiver features a slim design that's ideal for park flyers, gliders and other models with narrow fuselages. This dual-conversion unit has a range of 2,000 feet, weighs just 0.78 ounce and is 2.56x1x0.6 inches.

GWS (909) 594-4979; gws.com.tw.

BALSA USA
NIEUPORT-11

As the newest addition to Balsa USA's line of ¼-scale WW I planes, this Nieuport-11 is designed for electric, glow, or gas power! The 12- to 14-pound model has exceptionally gentle, predictable flight characteristics. The kit features die-cut wooden parts, full-size rolled plans, photo-illustrated instructions, bent-wire struts and fairings, special metal fittings, aluminum sheeting and a complete hardware package. Specs: wingspan—73 in.; wing area—1,450 sq. in.; length—61 in.; power req'd—Axi 4130/20 motor or equivalent; .90 to 1.20 4-stroke; or 23cc gas engine. The Nieuport-11 kit costs $200.

Balsa USA (800) 225-7287 (orders), (906) 863-6421; balsausa.com.

GWS
FORMOSA 3D

The GWS line of sport-scale electric park and backyard flyers is popular because the planes are easy to build, look great and fly beautifully. Now GWS is stepping into a new arena: 3D aerobatics! The first in a new line of 3D foamies, the GWS Formosa 3D is a profile design that's made of Depron foam and comes with a 350C motor. It also comes with a gorgeous set of decals to enhance its showstopper antics. We've heard through the grapevine that GWS will soon offer 3D warbird aerobats. We can't wait!

GWS (909) 594-4979; gws.com.tw.

GIANTSCALEPLANES
PAIR OF MUSTANGS

These ARF 1.40- and .50-size P-51Ds are sure to please! They feature laser-cut wood construction, a great-looking covering scheme, fiberglass cowl and factory-applied decals with clear paint over them. The 1.40 version has scale sectioned flaps to aid in low-speed handling and takeoffs. Specs 1.40-size: wingspan—72 in.; length—65 in.; wing area—915 sq. in.; weight—10.2 to 10.4 lb.; radio req'd—5- to 6-channel w/6 or 7 servos; engine req'd—1.30 to 1.50 4-stroke. Specs .50-size: wingspan—53 in.; length—46 in.; wing area—481 sq. in.; weight—6 to 6.2 lb.; radio req'd—4- to 5-channel w/5 or 6 servos; engine req'd—.40 to .46 2-stroke or .52 to .63 4-stroke. The 1.40 Mustang costs $280; the .50 costs $200.

GiantScalePlanes.com (610) 282-4811; giantscaleplanes.com.

HOBBY LOBBY INTL.
THE JUDGE EDGE 540

With its large control surfaces, this plane can perform wild aerobatics, but with reduced control throws, it's also great for learning 3D. It features preprinted-foam construction with carbon-fiber reinforcement for outstanding strength and stiffness. You don't have to wait for calm conditions to fly this one; it is rock-solid in the air and retains energy throughout all maneuvers. The kit includes printed foam parts reinforced with carbon fiber, lightweight foam wheels, motor mount and hardware. Specs: wingspan—38½ in.; length—37 in.; wing area—287 in; weight—16 oz.; radio req'd—4-channel w/5 servos. The Judge Edge 540 costs $60.

Hobby Lobby Intl. (615) 373-1444; hobby-lobby.com.

"Whether you're building or flying it, YOU CAN'T GO WRONG WITH THIS SUPER CHIPMUNK!"

BY ROBERT REID > PHOTOS BY JOHN REID & ROBERT REID

GREAT PLANES MODEL MFG

SUPER CHIPMUNK

Aerobatic Superstar

FOR MORE THAN 25 YEARS, STUNT PILOT ART SCHOLL THRILLED AUDIENCES across the globe with his highly aerobatic Super Chipmunk. I witnessed his aerial show many years ago and was amazed at what he could do with that airplane. For the show's finale, he performed his signature move: flying inverted down the runway and cutting a ribbon with the fin of the plane. Now, Great Planes has produced a 1.20 ARF Super Chipmunk, and it's one of the finest ARFs I've seen. It features a high-quality, painted fiberglass fuselage with panel lines molded in and built-up wing and tail feathers covered in MonoKote. It also includes a fiberglass wing belly pan, wheel pants and cowl, a complete hardware package, 24-ounce fuel tank, an impressive set of decals, 4-inch wheels and a tailwheel. A 30-page instruction manual offers many photos and shows how to put this great plane together.

SPECIFICATIONS

MODEL: Super Chipmunk
MANUFACTURER: Great Planes Model Mfg.
TYPE: sport-scale aerobat
LENGTH: 62.5 in.
WINGSPAN: 81 in.
WING AREA: 1,000 sq. in.
WEIGHT: 13 to 14 lb.
WING LOADING: 29 to 32 oz./sq. ft.
ENGINE REQ'D: .91 to 1.08 2-stroke or 1.20 4-stroke
RADIO REQ'D: 6-channel w/7 servos
PRICE: $380

COMMENTS

The Great Planes Super Chipmunk is a well-built ARF and comes with very clear, detailed instructions. In the air, it's as smooth as a pattern ship and can do all the maneuvers its big brother can.

HIGHLIGHTS

- Great fiberglass fuselage, cowl and wing belly pan
- Complete hardware package
- Detailed instruction manual with many photos

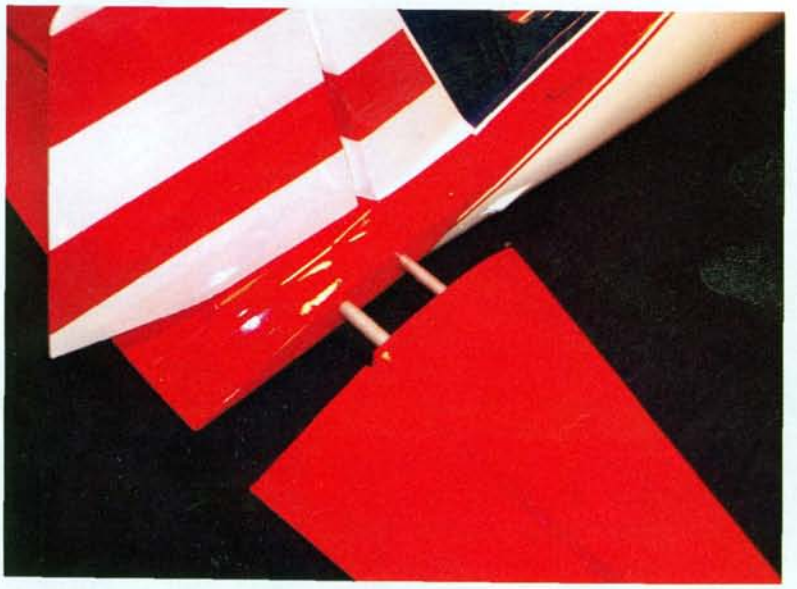
WING ASSEMBLY

Wing construction begins with the installation of the ailerons using the supplied hinge material. Position the hinge slots in the wing and drill a 3/32-inch-diameter hole in the center to allow the CA to wick in. Do this for the ailerons and flaps, install the hinges, and attach the ailerons and flaps.

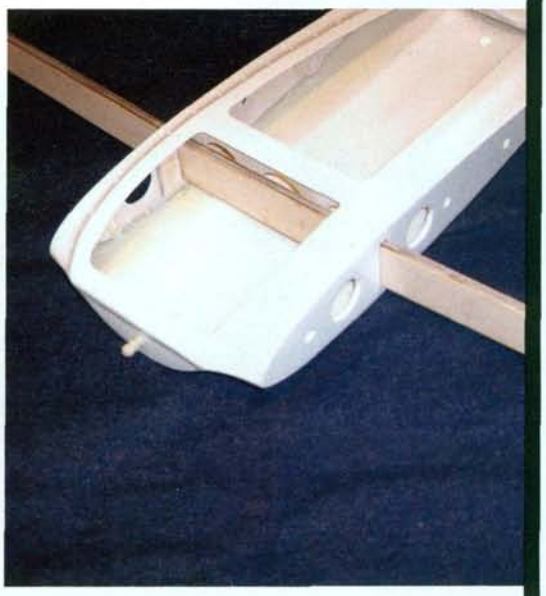
Cut the covering away from the aileron- and flap-servo openings, and when you install the aileron servos, make sure that the servo arms are pointing toward the wingtips. When you install the flap servos, make sure that the servo arms are pointing toward the root on the right wing and toward the wingtip on the left wing. By doing this, you will line up the servo arms with the plywood plate on the aileron and flap. The instructions for installing the pushrods that connect the servos with the control surfaces are very detailed and even offer tips on soldering the pushrods. Then epoxy the two nylon anti-rotation pins into the root of each wing half.

Now glue the aluminum wing joiner and two 1/8-inch-thick plywood wing joiners into the center section of the wing. After the glue has dried, check the fit with the fuselage and wing halves. Center the joiner in the wing's center section, and slide the wing halves onto the joiner. The wing halves are held in place with two 1/4-20 wing bolts that have knurled heads. This attachment method gives you the flexibility to either leave the wing as one piece or disassemble it into two or three pieces for easier transportation.

To install the landing gear, cut the covering away from the slot in the bottom of the wing and install the landing gear with nylon



Two aluminum rods join the stabilizer to the fuselage.



The wing center belly pan with the plywood/aluminum wing joiner in place.

PHOTO BY JOHN DIBBS/THE PLANE PICTURE CO./PLANEPIX.COM

SUPER CHIPMUNK—BALLERINA WITH AN ATTITUDE

BACK IN THE DAY, AEROBATIC FLIGHT was considered an art—a ballet. Whereas today's airshow pilots depend on speed and brutal, not-to-be-believed gyroscopic maneuvers, airshow pilots of the past valued grace and beauty, and the supreme practitioners of that three-dimensional dance were Hal Krier and Art Scholl and their Super Chipmunks.

Few airplanes are as aptly named as the de Havilland DHC-1 Chipmunk. It was born to frolic and is still the standard by which the smoothness of all other airplanes is measured. Even as it rolled out of the factory with its puny 145hp Gypsy engine—the same one as powered the Tiger Moth—it was an absolute delight to fly. The ailerons are light and smooth, and in a stock 'Munk, there's no doubt that you're flying on the wing—not the engine—because there's plenty of the former and not much of the latter.

The airplane is obscenely pleasurable to fly, but the instant the nose comes up, it's abundantly apparent that the 4-cylinder boat anchor under its long nose isn't sufficiently powerful. This was of no consequence in its original role as primary trainer for the Canadian and English air forces, but if it intended to be a serious aerobat, things had to change. And they did.

Hal Krier was among the first notable American airshow pilots to discover the delights of the Chipmunk, and he injected performance into it in the form of a 6-cylinder, in-line 200hp Ranger from an old Fairchild. Krier's supersmooth shows in the airplane inspired a generation of young aerobats (this writer included) to attempt to emulate his choreography and style. It also inspired Art Scholl to carry the art of Chipmunk modification to an extreme.

Scholl, often called "Wile E. Coyote" by his friends, had a more aggressive style than Krier's. He wanted more performance from the 'Munk, so he chose a GO-435 Lycoming as his engine. This was a geared, 260hp flat-four that grumbled along at more than 3,000rpm while the big prop was turning less than 2,500rpm.

The Chipmunk airframe hadn't been designed to take the abuse of serious aerobatics, so the Scholl/Krier airframe modifications became standard. Three feet were whacked off each wingtip, effectively increasing the strength, which was also bolstered by internal mods. The fuselage was usually reskinned or double-skinned because the original skin was little thicker than a sheet of tinfoil. The distinctive de Havilland cough-drop-shape rudder was replaced by the much larger surfaces required for handling additional power and for low-speed maneuvering.

Scholl's primary machine featured a truly radical modification: a retractable gear (RG). Although he had two 'Munks—one with fixed gear, one with retractable—it is the RG airplane that he's most closely identified with. This modification required massive engineering changes in the wings and center section, and although many pilots who came after him have copied his other mods, none are known to have gone as far as sucking the wheels inside.

"Super Chipmunk" is a great name for this airplane. It's a fun-loving craft with an attitude, and that's a good thing.

—Budd Davisson

Visit Budd on the Web at airbum.com.

straps. The wheel pants are also held on with nylon straps, but you'll need to glue two fiberglass landing-gear fairings onto the struts just above the wheel pants. Nothing difficult here!

FUSELAGE AND TAIL FEATHERS

Great Planes has included a handy fuselage stand that you attach to the fuselage with two ¼-20 nylon wing bolts. This is extremely useful while you work on the fuselage and especially when you attach the tail feathers and mount the engine. The horizontal-stabilizer halves are joined by two aluminum tubes, in the same way as the wing is joined. You must hinge the elevator halves to the stabilizer. To attach the stabilizer to the fuselage, apply epoxy to the stabilizer fairing, slide the stabilizer and its joiner into the fuselage and press it firmly to the fuselage. Hold this in place with masking tape while the epoxy cures. Now hinge the rudder to the fin.

To attach your engine of choice (I used a Magnum 1.20), cut out the appropriate engine template from the back of the manual and tape it to the firewall; be sure to align it with the dashes on the firewall. Drill the holes and install the supplied engine mount. Great Planes has even built the right thrust

IN THE AIR

A Magnum 1.20 4-stroke with a stock muffler, Master Airscrew 16x8 prop and 15% 2- and 4-cycle Wildcat fuel provide plenty of power to pull this 13.5-pound plane with authority.

CONTROL THROWS

Elevator: ± 1 in. (high); ± 5/8 in. (low)
Aileron: ± 1 in. (high); ± 3/4 in. (low)
Rudder: ± 4 in. (high); ± 2 1/4 in. (low)
Flaps: 1 7/8 in. down

GENERAL FLIGHT CHARACTERISTICS

- **Stability:** this plane handles very well at high and low speeds; it's rock-solid in the air.
- **Tracking:** with its wide-stance landing gear, ground handling is very easy with very little right rudder needed. In the air, it goes where you point it.
- **Aerobatics:** the Super Chipmunk does all the aerobatic maneuvers that the full-size plane can do and is as smooth as a pattern ship.
- **Glide performance:** because it has a large wing area, deadstick landings are no problem, as this plane is a floater and easy to land.
- **Stalls:** by cutting the throttle to idle and pulling the nose up, the plane will go into a gentle stall that's easily recoverable.

PILOT DEBRIEFING

On the ground or in the air, the Super Chipmunk draws a crowd, but the greatest feeling comes when you start the engine and taxi out onto the runway. After about a 75-foot takeoff run, when you add a little elevator input, the plane will head for the sky. Once in the air, the fun begins because this plane was designed to perform all the aerobatics the original did: snap rolls, hammerheads, Cuban-8s, outside spins, tail slides and—if you're daring enough—an inverted ribbon pick-up. This plane is a joy to fly, and the extra 15 ounces in the nose did not affect its performance.

The Magnum 1.20 was a perfect fit; it flew the Chipmunk with authority. Landing this plane is easy; with such a large wing area, it slows down to a walk with no tendency to tip-stall. Touchdowns are smooth, and rollout is about 50 feet. In subsequent flights, I played with the flaps; they make the Chipmunk even more of a floater.

into the plane! Install the engine, the included fuel tank and the plywood servo tray that is pushed against the tank and then screwed into the fuselage.

Now it's time to install your radio gear. I used 7 Hitec HS-425BB servos that fit perfectly. The rudder and tailwheel are controlled by a pull-pull system, and again, the instructions are very detailed with many photos that show how to set this up. Great Planes also provides great instructions for the cowl installation, from making the cutout for the engine to noting exactly where to put the screws that hold the cowl on.

FINAL TOUCHES

The Super Chipmunk comes with a pilot, a canopy and a neat cockpit that you glue to the fuselage. I had to cut about 1/4 inch off the bottom of the pilot to make it fit under the canopy. Apply the high-quality decals, and you're almost ready for the field.

Before you can fly your Chipmunk, you'll need to balance it. Great Planes extensively test-flies its models to arrive at the best CG for a successful first flight. In this case, the manual notes that you should set the balance point at 4 3/4 inches from the front of the wing. The manual also states that the prototype needed 20 ounces of lead in the nose to achieve this balance point. I fastened my battery pack to the bottom of the engine mount, so I needed to add only 15 ounces of lead.

My hat is off to Great Planes for another fine product. If you're looking for a scale plane that flies great, I highly recommend the Super Chipmunk. You can't go wrong with this one!

See the Source Guide on page 151 for manufacturers' contact information.

GEAR USED

RADIO: Airtronics RD6000 w/7 Hitec HS-425BB servos

ENGINE: Magnum 1.20

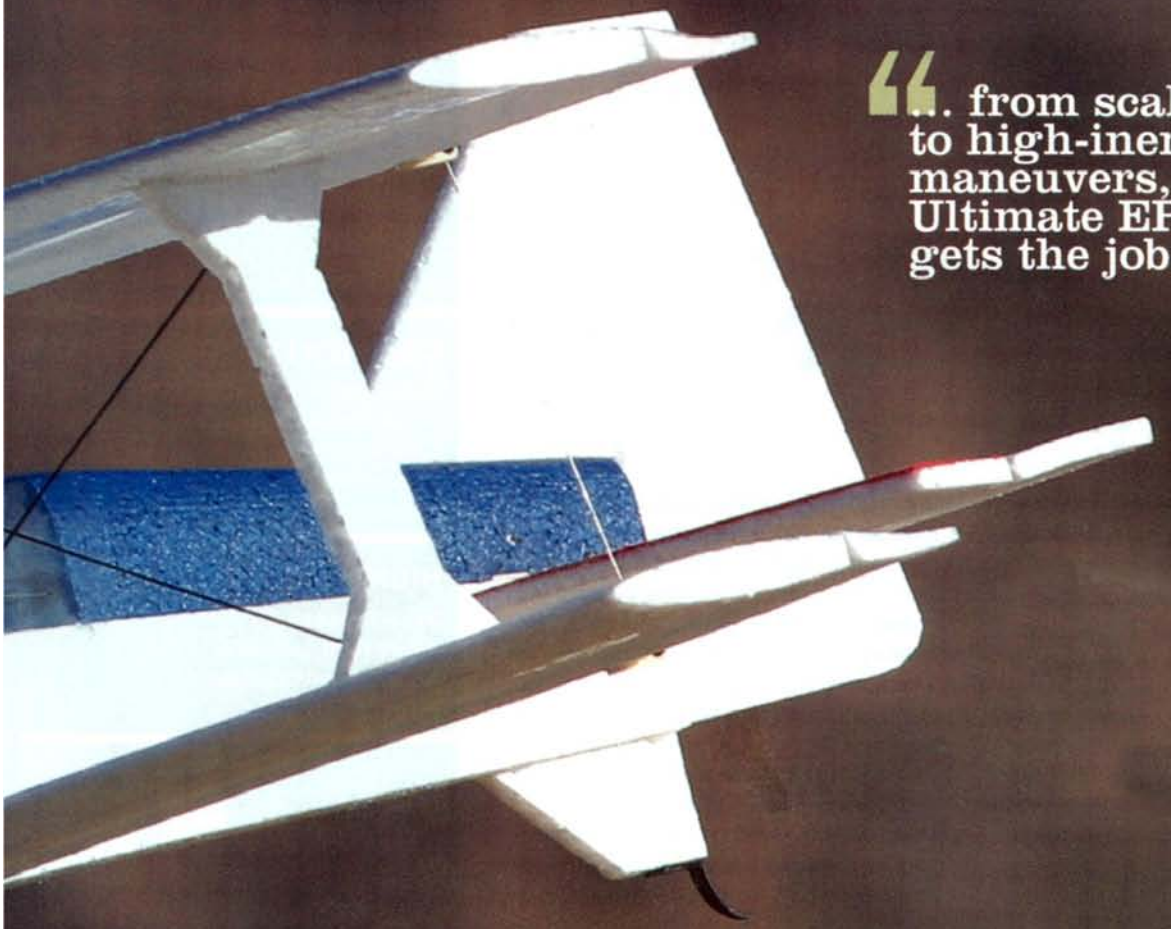
FUEL: Wildcat 2- and 4-cycle 15%

PROP: Master Airscrew 16x8

NORTHEAST SAILPLANE PRODUCTS

ULTIMATE EPP BIPE

BY DAVE HARRIS > PHOTOS BY JOHN REID



"... from scale flying to high-inertia 3D maneuvers, the Ultimate EPP Bipe gets the job done."

Two wings are more fun than one!

SINCE ITS RELEASE, THE ULTIMATE HAS BEEN ONE OF THE MOST COVETED and most replicated biplanes. Radio-control model enthusiasts and manufacturers agree that the Ultimate Bipe is the ultimate flying machine. The Northeast Sailplane Products Ultimate EPP Bipe is no exception: its small size and rugged construction make it the perfect backseat companion and an excellent reason to take the long way home from work.

SPECIFICATIONS

MODEL: Ultimate EPP Bipe
MANUFACTURER: Northeast Sailplane Products
TYPE: aerobatic electric biplane
WINGSPAN: 31.5 in.
WING AREA: 400 sq. in.
LENGTH: 31 in.
READY-TO-FLY WEIGHT: 14 oz.
WING LOADING: 5 oz./sq. ft.
RADIO REQ'D: 4-channel w/3 microservos
MOTOR REQ'D: brushless
FLIGHT DURATION: 10 to 15 min.
PRICE: $89.95; Axi airplane motor system, $194.95

COMMENTS

The Ultimate EPP Bipe is a nearly indestructible, fun-to-fly biplane. Its large flying surfaces permit it to maneuver quickly, and its high power-to-weight ratio allows unlimited vertical performance.

HIGHLIGHTS

- Quick assembly
- Very light airframe
- Strong construction
- Highly aerobatic

The kit's major components are hot-wire-cut out of EPP foam, and that is a great choice for an aerobatic model like the Ultimate, as it can take the abuse. The Kevlar and molded carbon-fiber landing gear is perfect for absorbing those less-than-perfect landings. The outer cabane struts are made of EPP foam, and the center cabane struts are made of a fiberglass material to add stiffness and strength. The kit includes carbon-fiber spars to stiffen the wings and carbon-fiber rods for the struts to tie the top and bottom wings together. The result is a very stiff and very tough airframe. The kit includes all of the necessary hardware, and the detailed instruction manual makes building the Ultimate an enjoyable task.

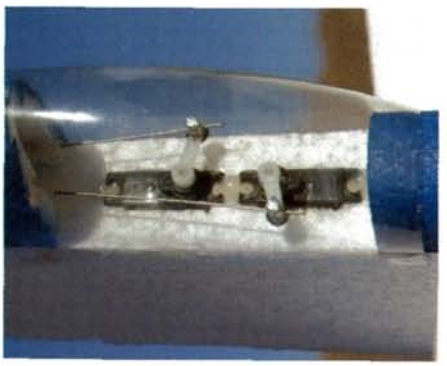
PUTTING IT TOGETHER

I started construction by inventorying and sorting out all of the parts. You'll need a large work area to lay out complete assemblies such as the wings and the stabilizer.

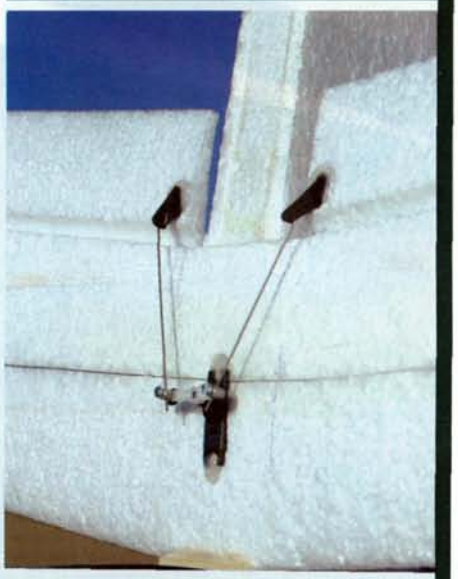
Fuselage The fuselage takes very little time to complete because most of the work has already been done for you. The top half of the fuselage is blue and has a nice tapered shape to it. The cabane struts are factory installed, and that saves a lot of assembly time. An EPP hatch covers the battery compartment at the front of the model, and I used self-adhesive Velcro® tape to attach it.

Installing the recommended Axi 2212/26 brushless outrunner motor is a snap. Just use 5-minute epoxy to glue the precut composite firewall to the fuselage. When the epoxy has cured, use screws to secure the motor to the firewall and you're ready to move on. To complete the power package, I used a Thunder Power 3-cell (11.1V) 1320mAh Li-poly battery and a Castle Creations Phoenix 25 brushless ESC. Northeast Sailplane Products provided this recommended drive system with the review plane, and its website offers these products as well as a vast selection of other power systems.

Wing assembly The Ultimate's two, one-piece, hot-wire-cut EPP foam airfoiled wings incorporate flat carbon-fiber spars glued into recessed areas on the underside of each wing. The upper and lower wings are slightly different; you should mark them after they have been identified so you don't mix them up. The four ailerons are also wire-cut and shaped to follow the wing's airfoil. Before you install the ailerons, thoroughly clean all of the surfaces. I used denatured alcohol to remove oil from the areas being hinged. Listed in the manual, there are several techniques for attaching the ailerons, and I elected to use hinge tape made out of clear, reinforced duct tape. Attaching the ailerons is simple: just flip the wing upside-down, align the surfaces leaving a 1/16-inch gap and apply the tape to the hinge line. Temporarily secure the ailerons with masking tape to prevent them from moving; then flip the wing over, double-check the aileron alignment and apply the hinge tape so it's centered over the hinge gap. Remove the masking tape, and you've finished.

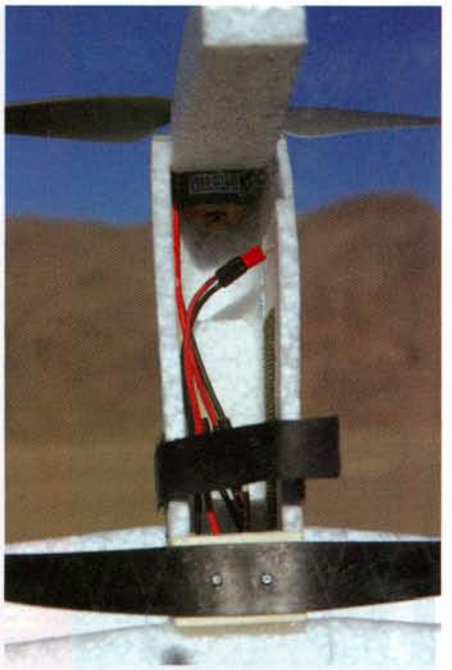


The rudder and elevator servos are installed under the clear canopy.



The underside of the bottom wing contains the aileron servo.

The Ultimate has plenty of bracing to prevent the wings from flexing.



The battery goes in this easy-to-access compartment in the front of the landing gear.

GEAR USED

RADIO: Hitec Eclipse 7 w/Berg 5 receiver, 3 GWS Pico servos, Castle Creations Phoenix 25 ESC

MOTOR: Axi 2212/26 brushless outrunner

BATTERY: Thunder Power 3-cell, 1320mAh Li-poly

Tail feathers I hinged the elevators and rudder to the horizontal and vertical stabilizers with CA hinges. You have to cut the hinge slots, so make sure that you space them evenly in the control surfaces to accept the hinges. Once you have cut the slots and centered the hinges, wick in a little CA to secure them. With the hinging completed, I used a hot-glue gun to attach the vertical fin to the fuselage.

Radio installation and final assembly Because of the enclosed fuselage, installing the radio gear takes a little longer than it does on other planes, but the payoff is well worth it. The Ultimate requires three servos: one for the ailerons, one for the elevator and one for the rudder. Embed the aileron servo in the bottom wing, and install the rudder and elevator servos under the clear canopy with their linkages running inside the fuselage. Under the nose, the battery hatch allows access to the ESC and the receiver. Unlike a flat profile model, this bird sports clean lines and has no exposed wires or hardware to detract from its scale appearance.

After I had installed the radio gear, I installed the transparent canopy, balanced the model and headed to the field!

BUILDER'S THOUGHTS

Northeast Sailplane Products' Ultimate EPP Bipe is fun to fly, and the Axi outrunner motor provides remarkable power. I recommend this biplane for intermediate and advanced pilots who want an inexpensive, easily transportable model that's tough enough to handle a few unintentional landings.

See the Source Guide on page 151 for manufacturers' contact information.

IN THE AIR

For the Ultimate Bipe, I used an Axi 2212/26 brushless outrunner, a Thunder Power 3-cell, 1320mAh Li-poly battery and a Castle Creations Phoenix 25 ESC. This combination provides plenty of power, so the model literally leaps off the ground and flies out of sight in just a few seconds.

CONTROL THROWS

Elevator: ± 1¾ in. (high); ± ¾ in. (low); 70% expo
Aileron: ± 1½ in. (high); ± ¾ in. (low); 50% expo
Rudder: ± 1½ in. (high); ± ¾ in. (low); 50% expo

GENERAL FLIGHT CHARACTERISTICS

Tracking: the Ultimate EPP Bipe has an excellent reputation for performance and tracking, and NSP's version is no exception. Just point the plane in the direction you choose; it does the rest.

Glide performance: on the first go-around, I overshot my landing area by about 50 feet, so on my second attempt, I used full up-elevator and no throttle, and the result was an almost vertical landing (just awesome glide elevators!).

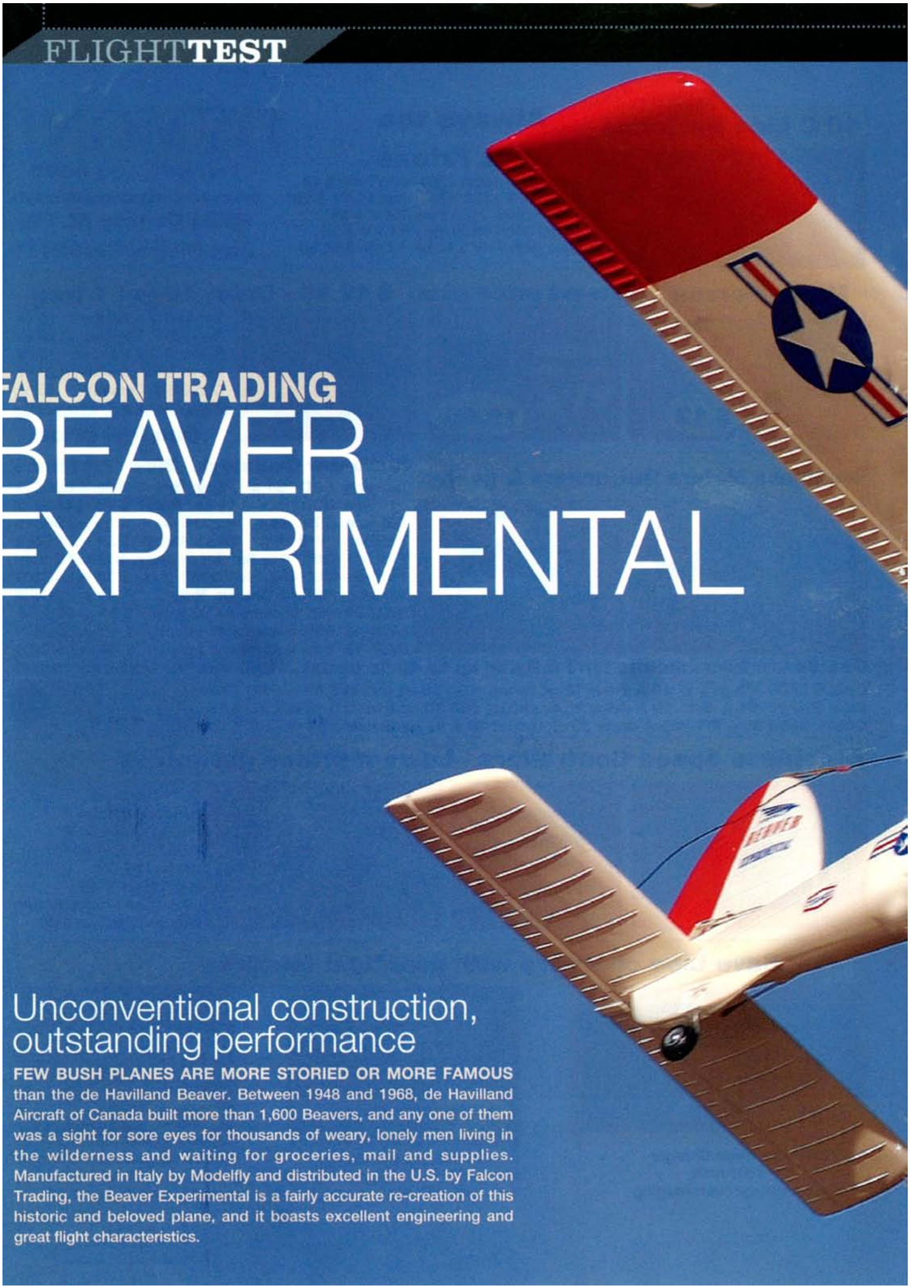
Stalls: NSP seems to have found a way to eliminate stalls because in the dozen or so flights I have made on the Ultimate EPP Bipe, I haven't experienced one yet.

PILOT DEBRIEFING

With a flying weight of only 14 ounces and 21 ounces of available thrust, the Ultimate has unlimited vertical and hovering ability. During your initial flights, give yourself time to get used to the aggressive maneuvering this plane is capable of, and take a little extra time to properly flight trim it. If you use a computer radio (as I recommend), use lots of exponential for the ailerons and elevator; this will lessen the effects of the aggressive flying surfaces and make the plane more docile.

The Ultimate has a wide speed envelope. In a mild headwind, with a little up-elevator and throttle, the model descends vertically with hardly any forward movement and without wing rocking—a real crowd pleaser. This bipe is also capable of effortless inverted flight with only minimal input. I'm also able to hover, torque roll and then blast vertically out of sight in seconds. I then knife-edge the Ultimate to the other end of the flying field. Low knife-edge passes and rolling circles are easy to do.

The Ultimate EPP Bipe is a real winner; from scale-flying to high-inertia 3D maneuvers, this plane is the one that gets the job done.



FALCON TRADING BEAVER EXPERIMENTAL

Unconventional construction, outstanding performance

FEW BUSH PLANES ARE MORE STORIED OR MORE FAMOUS than the de Havilland Beaver. Between 1948 and 1968, de Havilland Aircraft of Canada built more than 1,600 Beavers, and any one of them was a sight for sore eyes for thousands of weary, lonely men living in the wilderness and waiting for groceries, mail and supplies. Manufactured in Italy by Modelfly and distributed in the U.S. by Falcon Trading, the Beaver Experimental is a fairly accurate re-creation of this historic and beloved plane, and it boasts excellent engineering and great flight characteristics.

BY JET THOMPSON > PHOTOS BY JOHN REID

"This is a **UNIQUE, WELL-DESIGNED STAND-OFF-SCALE PROJECT** for flying from land or water."

SPECIFICATIONS

MODEL: Beaver Experimental
MANUFACTURER: Modelfly
DISTRIBUTOR: Falcon Trading
TYPE: semi-scale
LENGTH: 45 in.
WINGSPAN: 61¾ in.
WING AREA: 604 sq. in.
WEIGHT: 6½ lb.
WING LOADING: 24.79 oz./sq. ft.
ENGINE REQ'D: .46 2-stroke or .52 4-stroke
RADIO REQ'D: 4-channel w/4 servos
PRICE: $180

COMMENTS

This all-plastic plane is a nimble, light flyer that's easy to build and comes with a complete hardware package.

HIGHLIGHTS

- Unique, well-engineered construction
- Versatile—easily set up for float flying
- Very good flight characteristics

GETTING STARTED

I was excited to review the Beaver Experimental because it's so versatile and can easily be set up for land- or water-based operation. Falcon Trading also offers an optional set of floats that's designed to work with it.

The Beaver's construction is a bit unusual in that it is made entirely of molded plastic. This means that the whole plane is waterproof! It's a quick build, and the parts all fit perfectly. You'll have to sand a bit to remove some flashing, but that's about it. Because it comes molded in white plastic, you have to paint only the parts of the plane that you want. I chose to paint the cowl, wingtips and rudder.

The instruction manual comes with a large poster with photos of each of the 48 construction steps. Each photo is captioned in Italian, but the accompanying multilingual instruction book has excellent English translations of each step.

WINGING IT

The wing comes in two pieces, but unlike the rest of the plane, the molded plastic halves are filled with foam that adds rigidity and strength and prevents the plane from sinking if it is swamped. A doubler piece that fits over the root of each piece joins the halves. This piece sets the dihedral and ensures that the wing halves have the correct incidence.

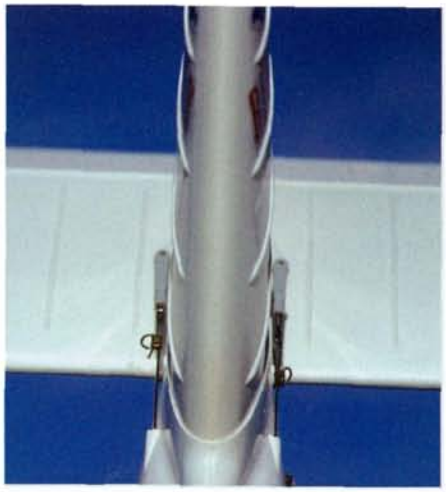
All of the control surfaces come molded and permanently attached to the flying surfaces, so you don't have to hinge them. Installing the aileron actuation mechanism is a simple matter of gluing root caps onto the aileron root ends and then inserting torque rods into place.

The wing struts aren't functional but really enhance the scale look of the plane. They are hinged at both ends and are permanently attached to the wing. When it's time to attach the wing, swing down the struts and simply slip them over tabs that are glued to each side of the fuselage. You don't have to remove any screws for the struts; the wing itself is held in place by one large screw through its center. Four dots that are aligned with the corners of the wing saddle prevent the wing from shifting in flight. I wondered how effective that would be for holding the wing in place, so I tried to twist it out of alignment. I had to push pretty hard to move the wing, so I am very confident that it will stay put.

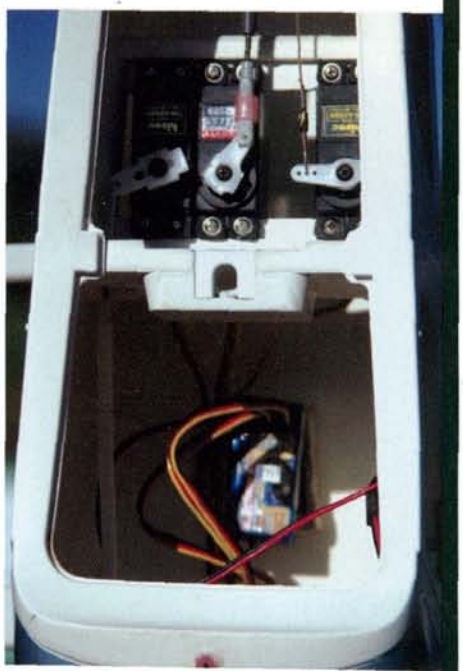
MAIN COURSE

The one-piece fuselage has molded-in details such as rivets, panel lines and doors. Putting the fuselage together is essentially a matter of

The engine head aligns perfectly with the precut cowl.



All of the surfaces are airfoiled, and the rudder is pull-pull.



The fuselage has plenty of room for the radio components.

IN THE AIR

The Beaver is a spirited plane that flies light and is quite responsive to control inputs. My O.S. .46FX has plenty of power and allows the plane to climb far more aggressively than a real Beaver ever could.

CONTROL THROWS

Elevator: ± ½ in.; 30% expo
Aileron: ± ½ in.; 30% expo
Rudder: ± 1 in.; 15% expo

GENERAL FLIGHT CHARACTERISTICS

- **Stability:** the Beaver's reasonable wing loading and airfoiled surfaces give it predictable handling.
- **Tracking:** it flies a straight line but exhibits a bit of pitch coupling with rudder.
- **Aerobatics:** basic scale-like aerobatics are a blast.
- **Glide performance:** the moderate wing loading balances out the thick airfoil and makes deadstick landings easy.
- **Stalls:** straightforward stalls are no problem, but it takes patience to recover from induced spins.

PILOT DEBRIEFING

When I received this plane, I thought that it might be too heavy for the .46FX that I planned to use, but I was wrong. It's a jolly good flyer and actually more stable than some trainers! It draws lots of attention at the field because it looks great, and folks aren't used to seeing an all-plastic plane with this level of quality. In the air, it handles very positively and flies very light, and although the O.S. 2-stroke engine doesn't give the Beaver unlimited vertical performance, it provides sufficient power for basic aerobatics. It might seem childish, but I like to imagine that I'm an Alaskan bush pilot skimming the trees and making tough landings to deliver supplies to remote places.

assembling three bulkheads and gluing them into place. The forward bulkhead acts as the firewall. A molded recess in the rear of the firewall houses a ring that holds three nuts that secure the engine mount. A hole in the center of the firewall mates with the front of the fuel tank and has notches that accept the cowl-mounting tabs. This assembly fits in the fuselage; you have to glue it into place with medium CA. I ensured that it remained watertight by painting the seam with a mixture of epoxy and alcohol. This also prevents dirt and oil from getting into the rest of the fuselage.

The center bulkhead is positioned to the rear of the windscreen, where the main landing gear is attached to the fuselage. The landing gear fits through holes in the fuselage, and its root ends meet to form an inverted "V" in the middle of the center bulkhead. This configuration looks as if it would be weak, but the point at which the gear meets the fuselage sides forms a lever; as pressure is placed on the bottom of the wheels, the mount is pressed into its seat.

Position the rear bulkhead to the rear of where the cabin doors would be; it primarily serves as the mounting point for the bolt that holds the wing to the fuselage. It is fitted up against the top of the fuselage, so the tighter I make the wing bolt, the stronger the joint becomes. This bulkhead also provides a mounting point for the servo tray.

SHAKE A TAIL FEATHER

The horizontal stabilizer comes in two pieces that I glued together with epoxy. A wooden spar runs through the halves to give them rigidity. A plastic piece that also serves as the elevator control horn connects the elevator halves. The elevator is fitted to the fuselage so that the control horn is on the top side and is aligned with a hole at the rear of the fuselage that provides access to the elevator pushrod. The manual recommends that you attach this assembly to the fuselage with thin CA. I carefully checked to make sure that the horizontal stabilizer was perfectly square with the fuselage centerline, as that measurement is crucial to the plane's flying true.

The one-piece vertical stabilizer has a control horn glued to the bottom of the rudder. The rudder is actuated by a pull-pull mechanism whose cables exit the fuselage through two small molded exits. The plane also has supplemental instructions and hardware for a steerable tailwheel.

WRAPPING UP

My side-mounted O.S. .46FX fit in the cowl perfectly. The fuselage, cowl and firewall have recesses to accommodate a stock muffler. The engine head fits through a precut hole in the cowl, and there was just enough room to allow the thrust washer to protrude a few millimeters from the front of the cowl while the fuel lines pass unobstructed through the firewall at the rear of the engine.

The servo tray has plenty of room for three standard servos side by side, but I had to enlarge the opening a bit to accept the length of the servos that I used. Last, I checked the balance and mounted the battery under the fuel tank for a good center of gravity.

I was quite impressed by this high-quality kit; the parts fit perfectly. The Beaver flies very well as a land-based plane, and I'm eager to try it out as a floatplane. This bird gets an "A"! ✈

See the Source Guide on page 151 for manufacturers' contact information.

GEAR USED

RADIO: JR XP8103 transmitter, Hitec Electron 6 receiver, Hitec HS-425 BB servos

ENGINE: O.S. .46FX

FUEL: Powermaster 10%

PROP: Zinger 10x6

This gorgeous model has a HIGHLY AEROBATIC FLIGHT ENVELOPE.

BY PETER ABBE > PHOTOS BY PETER ABBE & CHERI SASSMAN

BME AIRCRAFT 27% PITTS CHALLENGER

Smokin' aerobat

I HAVE ALWAYS BEEN FASCINATED BY MUSCLE BIPLANES, AND Sean Tucker's Oracle Challenger is no exception. Although the Challenger may not appear to be much different from many other muscle bipes, it is a one-of-a-kind, custom-built aerobatic machine that consists of modified Pitts Super Stinker wings mounted to an Eagle I fuselage and driven by a 360hp Lycoming engine. BME Aircraft's Pitts Challenger reproduces the excellent quality and performance of the original in 27-percent scale. Featuring lightweight, built-up balsa and plywood construction and a high-quality fiberglass cowl and wheel pants, this model quickly assembles into a gorgeous replica of the original.

SPECIFICATIONS

MODEL: 27% Pitts Challenger
MANUFACTURER: BME Aircraft
TYPE: giant-scale aerobatic biplane
WINGSPAN: 64 in. (top wing), 62 in. (bottom wing)
TOTAL WING AREA: 1,420 sq. ft.
LENGTH: 60 in.
WEIGHT: 17 lb.
WING LOADING: 27.6 oz./sq. ft.
POWER REQ'D: 40 to 60cc gasoline engine
RADIO REQ'D: minimum 4 channels with 6 high-torque servos for control surfaces and 1 standard servo for throttle
PRICE: $499.99

COMMENTS

BME's Pitts Challenger is a high-quality, completely built-up balsa and plywood model with excellent fiberglass parts and matching film covering.

HIGHLIGHTS

- Finished appearance
- Lightweight, built-up construction
- Stable, aerobatic performance

KIT CONTENTS

The model was well packed in a large box with all the components, hardware and decals individually bagged. The quality of construction and the covering job were as nice as any I have ever seen on an ARF; however, a close examination revealed several small dents in one of the wing panels. I contacted BME and was promptly sent a replacement panel.

My only complaints about the kit concern the instruction manual and hardware package. Although the manual contained many photos, certain construction phases were difficult to follow. BME's phone support proved very helpful in clarifying the assembly issues not addressed in the manual. The hardware package consisted of the wheels and landing gear, CA hinges (later kits have been upgraded to include hinge-point-style hinges) and most of the bolts required to complete the assembly. I found it necessary to replace all of the supplied 4-40 bolts because the cap heads did not fit a standard-size driver, and some of the other bolts were of the incorrect length. The builder must supply a fuel tank, control horns, linkages and an engine mount.

TAIL FEATHERS

The fin and stabilizer are epoxied into place after removal of the covering where they contact the fuselage. When you hinge the control surfaces, it's important to keep the gaps as tight as possible without limiting control-surface deflection. I found it necessary to place an ⅛-inch-plywood shim beneath the aft elevator-servo mounts to provide adequate clearance for the servos inside the fuselage. I used a reversing Y-harness to keep the elevators moving in the same direction; this could also be done using digital servos and reversing one servo's rotation.

FUSELAGE

The cabane struts pass through cutouts on the top of the fuselage and are bolted inside the fuselage with 4-40 bolts. I enlarged these cutouts slightly to ensure a proper fit. Don't hesitate to use thread-lock liberally on the bolts because after the firewall has been installed, it's very difficult to access these bolts, and you don't want them to vibrate loose in flight!

I mounted the BME 50 to the firewall using a Du-Bro 1.20 vibration-reduction engine mount. Offsetting the engine 3⁄16 inch to the left, I used ⅛-inch-plywood shims behind the left mount to achieve the proper 3 degrees of right thrust. I chose a 3¾-inch Tru-Turn spinner for my Challenger because this brand is second to none.

After you've glued and pinned the firewall into the fuselage, it's easy to position and mount the cowl using 4-40 bolts. Be certain to cut ample clearance between the cowl and the spark-plug cable. I gave mine only ¼-inch clearance, and the engine vibration from the first flight caused the cowl to cut deeply into the spark-plug boot.

The wheels and wheel pants are attached to the main gear using the supplied axles and bolts. The gear is then bolted to the fuselage, and the center portion is concealed by a cov-

The aileron linkages are very short and tight. Du-Bro control horns, clevises and ball links were used throughout.

Cabane struts are bolted to the tab on the center plywood rib on the top wing. I wrapped the aileron-servo extension wires around the cabane struts and secured them with zip-ties.

Each elevator half is actuated by independent servos; I used a Du-Bro pull-pull cable system on the rudder.

IN THE AIR

The Pitts Challenger balanced out at the suggested center of gravity (CG) location of 1½ inches ahead of the bottom wing without adding any extra weight. This proved to be a conservative starting point in flight; however, the model had a tendency to nose over when taxiing in rough grass. Moving the CG further aft would simultaneously cure this problem and improve the Challenger's 3D performance.

CONTROL THROWS

Elevator: ±40 deg. (high); ±20 deg. (low); 20 to 30% expo
Aileron: ±35 deg. (high); ±17 deg. (low); 20 to 30% expo
Rudder: ±40 deg.; 20 to 30% expo

GENERAL FLIGHT CHARACTERISTICS

Stability: the model is very stable at high and low speeds. It is comfortable to fly and has no bad habits.

Tracking: the Pitts Challenger is the most responsive model I have ever flown. Even with aileron and elevator low rates set to 50 percent of control-surface deflection, the model rolls and snaps in the blink of an eye.

Aerobatics: pilot skill and setup are the only limiting factors here. By changing the CG and control throws, it can be tailored to suit virtually any style of aerobatics.

Glide performance: gliding is one maneuver this biplane does not perform well. If the prop stops turning, you do not have the luxury of leisurely gliding back to the runway. So far, I have had one deadstick landing and one long walk to retrieve my airplane!

Stalls: the model has to be slowed considerably and brought to a moderately high angle of attack before it drops its left wingtip. Recovery is quick when elevator pressure is released and power is added.

PILOT DEBRIEFING

Loops track very well, and rolls are lightning fast and axial. The rudder has enormous authority; very little input is necessary to maintain knife-edge flight. I did notice a considerable amount of roll coupling and a strong tendency for the model to pitch toward the gear when excess rudder was applied; some mixing is necessary to correct this.

The wings have a fairly thin and sharp airfoil, which makes the model very sensitive to control input. Even with my elevator and aileron low rates set to 50 percent of control-surface deflection, things happened very quickly. If you're looking for 3D performance, you will have to move the CG back from the recommended starting point. The BME 50 engine has ample power for prop-hanging maneuvers and yields unlimited vertical performance.

ered balsawood block that is bolted into place. The high-quality tail-gear assembly is screwed to the fuselage and is actuated by springs that run between its tiller arm and a tiller on the rudder. The spring tension was very tight, so I reduced the tension by installing a short piece of music wire between the end of the spring and the tailwheel tiller.

Ample room is provided inside the fuselage to install the radio gear and the rudder and throttle servos. I mounted the rudder servo on two spruce rails and used a Du-Bro pull-pull cable system to actuate the rudder. It is very important that the rudder-servo mount be securely attached to the inside of the fuselage. There is considerable tension on the cables, and a weak mount could break loose during flight. It is also important to ensure that the elevator-servo extensions are secured to prevent them from flopping around inside the fuselage. I secured mine by drilling a small hole through one of the formers and attaching them to the former with a zip-tie.

WINGS

The wing panels are much easier to handle before they are joined, so I chose to install the ailerons, servos and linkages first. The wings are joined with epoxy and plywood dihedral braces. A tabbed plywood rib is sandwiched between the center portion of the upper wing panel. Be extremely careful that this rib is installed with the tab facing downward (in the same direction as the interplane strut tabs). If this rib is installed upside-down, it will render the wing useless.

An incidence meter is an absolute necessity for proper installation of the wings. When the lower wing's incidence is set at zero degree, the top wing's setting of -1½ degrees can easily be referenced off the lower wing. To achieve the proper incidence, I needed to redrill one of the holes in the center rib on the top wing. Take your time and be patient here; I wasn't satisfied with the final setup until I had taken incidence readings for about two hours. The wing installation is completed by gluing the built-up balsa belly pan to the lower wing.

FINISHING UP

The professional-looking vinyl decals are easy to apply. After lightly marking their positions on the airframe, use the supplied transfer sheet to remove them from their backing and then carefully position them on the model, remove the transfer sheet and smooth out any air bubbles. Applying the larger decals is a two-person process because applying them by yourself will likely result in their destruction!

To prevent scratching or denting the canopy, I always install it last. I chose to screw it into place with a few small wood screws so it would be easily removable, if necessary.

CONCLUSION

BME Aircraft's 27% Pitts Challenger is a top-notch aerobatic ARF. The quality of its construction, finish and flight performance makes this gorgeous model stand out on the flight line and in the air. Couple this airframe with a BME 50 engine, and you will have an unlimited muscle bipe with a thrust-to-weight ratio that would make Sean Tucker green with envy!

See the Source Guide on page 151 for manufacturers' contact information.

GEAR USED

RADIO: Futaba T-6XA transmitter, Futaba FP127DF 7-channel dual-conversion receiver, 6 Hitec HS-635HB servos, 1 Hitec HS-311 servo

BATTERY: 5-cell, 2000mAh NiMH Hydrimax

ENGINE USED: BME 50

PROP: BME 21x8

TOWER HOBBIES UPROAR 40

BY JOHN STEWART > PHOTOS BY JOHN REID

> **"... The Uproar ARF is an excellent FUN-FLY AIRPLANE for intermediate to advanced pilots."**

ARF

A roaring good time!

SOMETIMES, THE MOST ENJOYABLE PART OF THE RC FLYING experience is just getting away. Fast-paced lifestyles and hectic work schedules make flying time precious. Ironically, the high-tech aspects of our work lives have now spilled over into our hobby. Who would have ever dreamed that we would have fuel-injected model airplane engines or that real-time, onboard flight-monitoring systems would become a reality? All this technology is great, but every pilot's hangar needs a bird that is just plain fun! That's where the Tower Hobbies Uproar ARF fits in. This all-balsa and plywood design incorporates a permanently attached wing, and the result is a strong structure with a flyaway weight of about 4 pounds. Add to that great looks, minimal build time and a wide-ranging flight envelope that is stable and predictable yet still capable of outlandish 3D maneuvers, and you have a model that's perfect for any fun seeker.

SPECIFICATIONS

MODEL: Uproar 40 ARF
MANUFACTURER: Tower Hobbies
TYPE: fun-fly
LENGTH: 44 in.
WINGSPAN: 48 in.
WING AREA: 618 sq. in.
WEIGHT: 4 lb. 1 oz.
WING LOADING: 15 oz./sq. ft.
ENGINE REQ'D: .32 to .46 2-stroke or .40 to .52 4-stroke
RADIO REQ'D: 4-channel with 5 standard servos (rudder, elevator, throttle, 2 ailerons)
PRICE: $84.99

COMMENTS

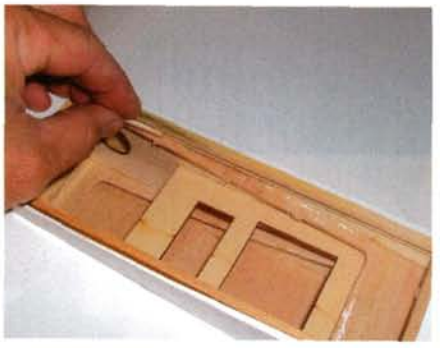
This is a quick-building ARF that is versatile enough for seat-of-the-pants 3D aerobatics or gentle touch-and-go's. Whatever your preference, the Tower Hobbies Uproar 40 ARF aims to please.

HIGHLIGHTS

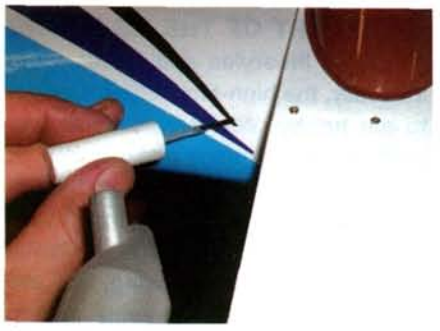
- Laser-cut parts and topnotch construction
- Assembles fast and straight
- Permanently attached wing minimizes weight

IN THE BOX

With the wide selection of sport-aerobatic, 3D-capable, .40-size ARFs on the market, selecting the "right" one is a matter of weighing quality, appearance, performance and price. Based on these criteria, the Tower Hobbies Uproar 40 ARF is a winner. The all-balsa and plywood airframe is expertly constructed and has been covered with iron-on material in an attractive multicolored scheme. The kit also features 3⁄16-inch main landing-gear wire, 2½-inch main wheels, a 1-inch tailwheel, an adjustable molded-nylon engine mount, an 8-ounce fuel tank, CA-style hinges, wooden servo trays, a tinted canopy, a hardware package and photo-illustrated instructions. Best of all, this ARF builds fast and straight; in 10 hours or less, you will move from the workbench to the flightline for some exhilarating fun.



Glue the wing into place by sliding it out of position by about ¼ inch; then apply epoxy, and slide it back into position so the epoxy is between the wing and the fuselage structure.



I used clear nail polish to hold the pointed ends of the graphics down. I've found that this method helps the decals stay put even after numerous cleanings.

CONSTRUCTION

Attaching the wing and tail feathers

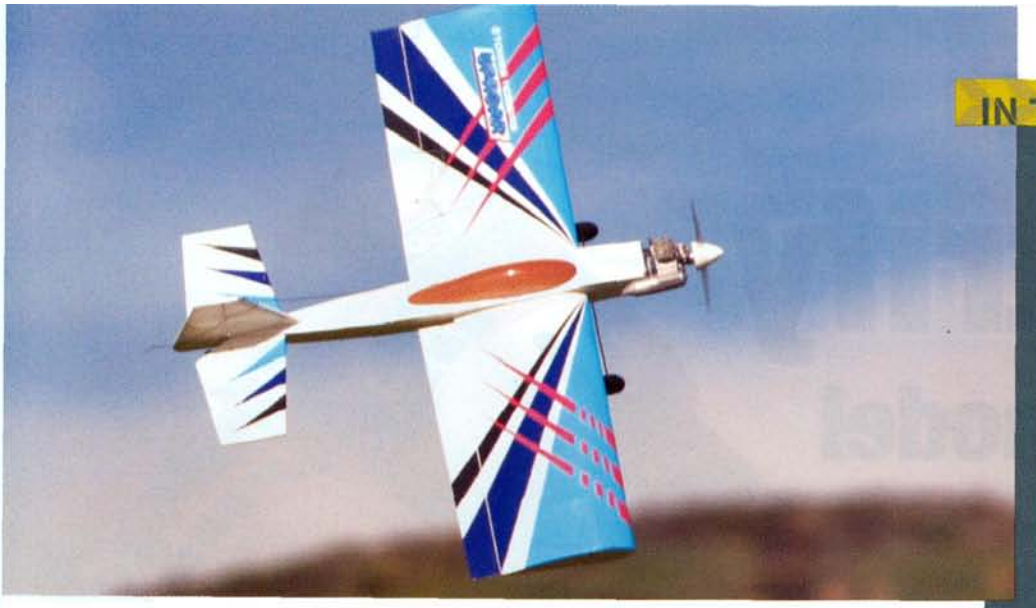
Permanently attach the one-piece wing to the fuselage by removing the covering material from the fuselage at the wing cutouts and then sliding the wing into position. The fact that a built-up balsa and plywood wing can be slid into position through two fuselage cutouts is testimony to the high quality and accuracy of this ARF's construction. After you've properly positioned the wing, mark the area on it where you'll remove the covering material. Slide the wing out, remove the covering material, reinstall the wing and then glue it to the fuselage with 30-minute epoxy. Make sure that the wing is accurately positioned while the epoxy cures, and be sure to clean off any excess epoxy with denatured alcohol and paper towels.

The elevator is in halves that are joined by a stiff U-shape wire. All the pieces have been prefit, so assembly is a snap. I epoxied the halves together and allowed the assembly to cure on a flat surface. The horizontal and vertical stabs interlock onto the fuselage easily and precisely. Prefit these parts to check for proper alignment and then attach them with 30-minute epoxy. Again, make sure that everything stays in alignment while the epoxy cures, and be sure to clean off any excess epoxy. After you've put the wing and tail feathers into place, attach the ailerons, the elevator and the rudder/tailwheel assembly with the included hinges.

Engine mount, fuel tank and landing gear

The fuselage comes with blind nuts installed

This picture shows the wing in place. The fact that you can slide a built-up balsa and plywood wing into position through two fuselage cutouts testifies to the quality and accuracy of this ARF.



for attaching the adjustable engine mount. All that's needed here is to install your engine on the mount and to attach the throttle linkage. With the engine in place, install the supplied fuel tank on a layer of ¼-inch RC foam rubber, run your fuel lines and secure the fuel-tank hatch with the provided screws. The instruction manual states that the model will typically require tail weight if you install a heavier engine. In this case, to minimize the amount of weight needed, position the engine as far back on the mount as you possibly can. Since I was installing an O.S. FX .46, I positioned the engine all the way to the back of the engine mount and left just enough room to run the fuel lines. The last step here is to attach the landing gear and lightweight foam wheels.

Radio installation Access to the radio compartment is through a hatch at the bottom of the plane. The removable hatch also includes two cutouts that I used to install a switch and a battery-charging jack. Install the servos in the fuselage as instructed, and then attach the control rods with the provided hardware.

The ailerons use twin servos. You can connect the two servos using a Y-harness or, if you're going to use a computer radio, you can choose to install the ailerons on separate channels. I opted to use separate channels because this allows more control options such as aileron differential or flaperons.

With the O.S. FX .46 installed and the battery pack mounted as far back as possible in the radio compartment, I ended up burying 3 ounces of lead in the tail to balance at dead center of the recommended range. I felt that 3 ounces in the tail was a small price to pay in exchange for bolting the powerful O.S. FX .46 on the nose.

FINAL TOUCHES

The next order of business is to cut out and attach the tinted canopy. I used Formula 560 canopy glue from Zap to achieve a strong, clear bond. As an additional step, I dabbed clear fingernail polish on the pointed edges of the iron-on graphics. Although the graphics were well attached at the factory, it has been my experience that fuel residue and cleanups tend to cause those delicate edges to curl up. Clear fingernail polish prevents this, and it also works well as thread-lock.

All that's left now is to set the control throws, double-check the model's CG and—by all means—take a few minutes to go through the checklist at the end of the instruction manual so that your first flights are successful. Now it's off to the field.

CONCLUSION

The Tower Hobbies Uproar ARF is an excellent fun-fly airplane for intermediate to advanced pilots. The flight characteristics of this great-looking ARF will easily meet the needs of laidback weekend fliers as well as hot-dogging extremists. If you're looking for an attractive, great-flying plane that's light and priced right, take a look at the Tower Hobbies Uproar ARF. It will put a smile on your face—guaranteed!

See the Source Guide on page 151 for manufacturers' contact information.

GEAR USED

RADIO: Futaba 9CAP transmitter, Hitec RCD 3500 receiver, 5 Hobbico CS-67 standard ball-bearing servos

ENGINE: O.S. .46 FX 2-stroke

FUEL: PowerMaster 15%

PROP: APC 10x7

IN THE AIR

IN THE AIR

The Tower Hobbies Uproar has power to spare. Its ground-handling characteristics are solid, and it lands like a trainer; but it's what happens between takeoffs and landings that makes this ARF a blast to fly. Lightening-fast rolls, incredible snaps and extremely tight loops can be flown with ease, yet this bird is just as comfortable settling down for some split-S maneuvers, stall turns, or inverted flight.

CONTROL THROWS

Elevator: ±¾ in. (high); ±½ in. (low); expo 40%
Aileron: ±¾ in. (high); ±½ in. (low); expo 40%
Rudder: ±1¼ in. (high/low); expo 40%

GENERAL FLIGHT CHARACTERISTICS

Stability: this plane is stable and predictable throughout all throttle settings both on the ground and in the air.

Tracking: the Uproar tracks nicely in all attitudes, and the control responses are crisp and accurate.

Aerobatics: yes! If you can provide the input, the Uproar will carry out the command!

Glide performance: outstanding; during one flight, I deadsticked the Uproar at about 40 feet with zero airspeed. I simply pushed the nose over to regain airspeed and gently landed without incident.

Stalls: with such light wing loading, you really have to work to stall this airplane. When the Uproar does stall, the stall is gentle, and there is no tendency to drop a wingtip.

PILOT DEBRIEFING

One thing I like about the Uproar is its permanently attached wing. The plane is quite literally ready to fly once you arrive at the field.

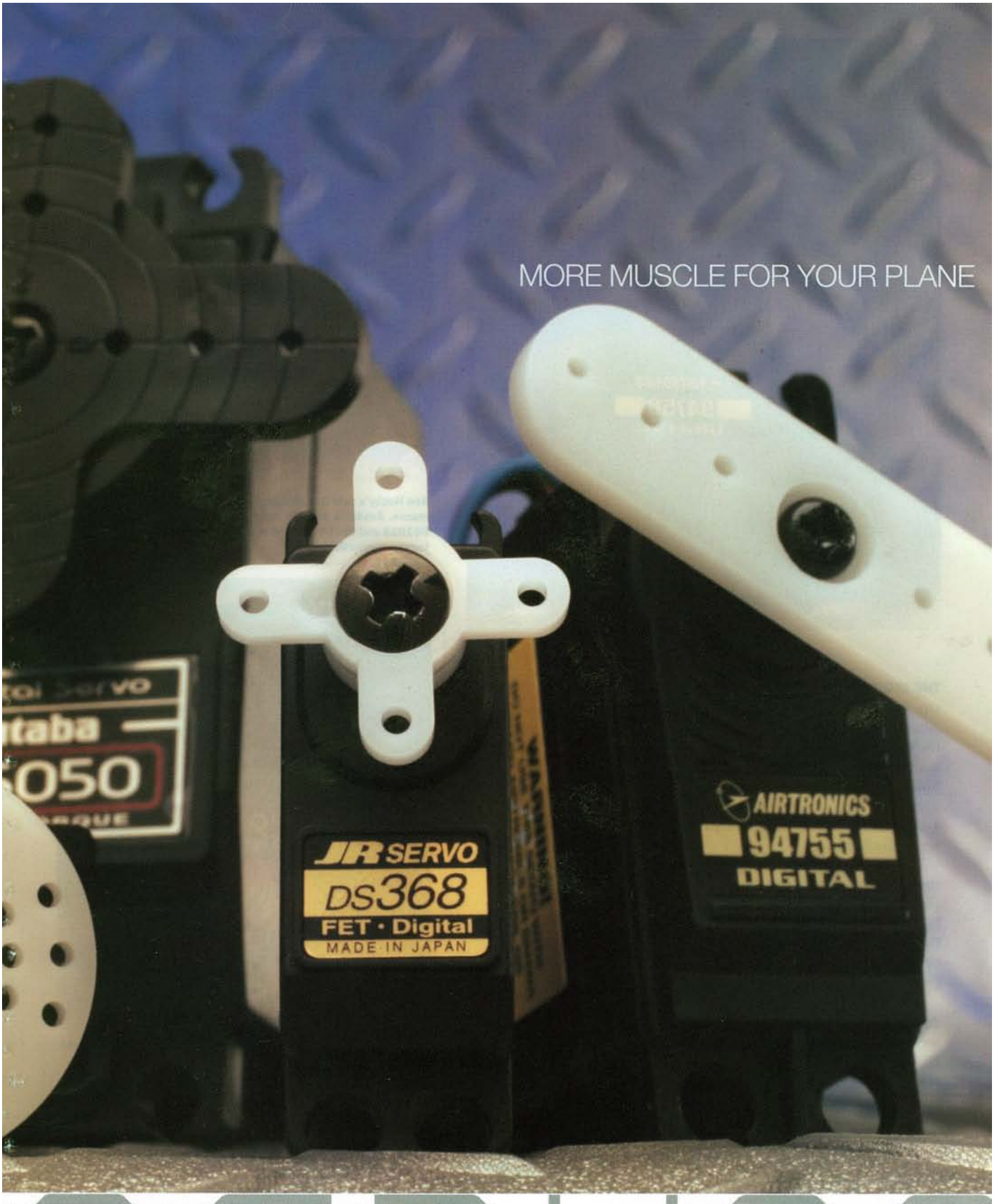
Very little runway is needed to get this plane airborne, and once in the air, the light airframe allows altitude to be gained quickly. The plane flies consistently throughout all power settings, and despite the oversize control surfaces, the Uproar does not tend to get "twitchy" at higher airspeeds. This plane goes exactly where you point it.

This plane is completely aerobatic and is capable of almost any maneuver, but it is also exceptionally stable and easy to fly. Slow-speed flight is completely predictable, and the control surfaces never feel sluggish or unresponsive. Light wing loading and a fully symmetrical airfoil allow this plane to bridge varying flight envelopes to meet the needs of almost any flier.

BY JOHN REID PHOTOS BY DERON NEBLETT

DIGITAL

"WHY SHOULD I SPEND THE EXTRA MONEY for digital servos?" This is probably the number-one question that fliers ask me whenever I talk to them about radio gear. There are many reasons why digital servos are worth the extra expense, but there are a few reasons why it may not be worthwhile to buy them. Before we discuss any of their pros and cons, however, let's talk about how digital servos work.


MORE MUSCLE FOR YOUR PLANE
JR SERVO
DS368
FET • Digital
MADE IN JAPAN
AIRTRONICS
94755
DIGITAL

SERVOS

Ace Hobby's new line of digital servos offers power and performance. Available with JR- and Futaba-compatible connectors, the DS1013 and the DS1211 offer up to 180.5 and 149.9 oz.-in. of torque, respectively.

THE DIGITAL ADVANTAGE

On the outside, digital servos look like high-quality analog (standard) servos. They have the same motor (and sometimes the same gear train); however, a digital servo contains a microprocessor that provides quicker response time and stronger holding power. The presence of the microprocessor (a tiny computer) is the primary difference between a digital servo and a standard servo. It significantly affects the way a digital servo functions.

A conventional servo compares the receiver's command with the actual position of its output shaft each time the receiver sends a new pulse command. The pulse is just one part of the body of digital information being transmitted to the receiver. Depending on the brand of radio and the number of channels being transmitted, information is typically sent about 40 to 50 times per second.

A digital servo's microprocessor meters the position of the output shaft much more frequently—typically, at 300 times per second—and that is six times faster than a standard servo's capability. This rapid updating gives the digital servo a much quicker response time than a standard servo can provide.

Digital servos don't have to be giants. This Polo Digi 4 from Multiplex has a case that measures 1¼x⅞x½ inches. It features a 3-pole ferrite motor, metal gears and dual ball bearings, and it delivers 39 to 49 oz.-in. (4.8 to 6 volts) of torque.

As you can see, digital servos come in all shapes and sizes. Big or small, there's one that's perfect for any application.

The Hitec Digital Servo Programmer can also be used to test any brand of transmitter for the pulse sent to the receiver as well as the servo voltage and proper servo-arm movement.

A digital servo's rapid updating also creates a stronger control-arm command. For example, if you try to rotate the servo arm of a digital servo from the position it has been commanded to hold, it will attempt to correct that position six times faster and thereby develop its maximum torque much more quickly than a standard servo. A standard servo does not develop its maximum torque until the servo arm has been displaced many degrees from its desired position. In contrast, the digital servo reaches its maximum torque after a much smaller rotation of the servo arm. This gives the digital servo a much greater centering position and much more power.

That is why you'll often notice a high-pitched hum emanating from a plane that uses digital servos. The sound is generated as the digital servos labor to continue holding the output shaft's position.

CUSTOMIZE YOUR DIGITAL SERVOS

With their precision and powerful performance, digital servos have a lot to offer, and some brands even allow you to reprogram their microprocessors. All Hitec digital servos are programmable with the HFP-10 Digital Servo Programmer that allows modelers to change the travel direction, servo speed, neutral point, endpoints and fail-safe position.

Of course, you could program all of that through higher-end computer radio systems, but if you program the servos, you'll be able to use less equipment inside the aircraft, and that saves weight. For example, dual flaps or dual-elevator surfaces require one servo to operate clockwise and another to operate counterclockwise. This typically requires two extra channels on the receiver for each servo plug, and then the appropriate channels have to be mixed together. With the HFP-10, each digital servo can be programmed with the correct rotation, identical deadband width, neutral points and endpoints. Now the two servos can be plugged into a Y-harness and then into one channel on the receiver without any radio mixing.

The latest generation of Hitec servos comes with a custom-designed, programmable circuit and the super-durable Alumite/MP gear train. The powerful HS-5645MG is perfect for high-torque applications, while the HS-5245MG is ideal when a small, lightweight, high-speed, high-torque servo is needed.

Mike McConville smiles for the camera while he takes a break at the 2004 Don Lowe World Masters.

Digital servos in competition

ONE OF THE MOST SIGNIFICANT TECHNOLOGICAL ADVANCES IN RECENT years to aid in aerobatic flying is undoubtedly the advent of digital servos. Whether you are into precision aerobatics, 3D, or just simple sport aerobatics, you must not overlook them.

Because I'm a serious aerobatics competitor, I'm always interested in getting the absolute most out of my airplanes, so I was quick to give digital servos a try. Also, being blessed with the opportunity to work for Horizon Hobby—the exclusive importer of JR radios—I was fortunate to be among the first in the U.S. to try digital servos. I'll never forget my amazement when I first installed JR 8411 digital servos in a 40-percent Carden CAP 232 back in early 1999. The difference in feel was very evident—and very good.

The real advantage of using digital servos is the holding torque. Simply put, a digital servo achieves its maximum torque when it is pushed off its commanded position by just a few degrees. Typically, an analog servo does not achieve its full torque until it is deflected from its commanded position by more than 20 degrees.

This holding torque makes a huge difference in the way a model flies. When an airplane flies, the control surfaces are subjected to many forces. Turbulence and other aerodynamic forces can be very strong on the control surfaces and will move them away from the position they are supposed to be holding. The lower the holding torque of the servo connected to the surface, the more the external forces will affect control-surface positioning. When this happens, the airplane reacts as if this was a commanded input. As a result, the model does not lock on; it moves around, so it won't track straight through loops, the wings wiggle, and control feels mushy.

Let's assume you know that a particular model requires 100 oz.-in. of torque to hold the ailerons at neutral under normal flight loads, and you install an analog servo that is rated for that much torque. Flight loads can push the aileron away from the position the servo is trying to hold until the servo is moved more than 20 degrees; at that point, it produces 100 oz.-in. of torque.

Look at the same scenario with a 100 oz.-in. digital servo installed. The aileron can only be moved until the servo has been pushed a few degrees; it then produces 100 oz.-in. of torque and stops the movement. The result is that the model feels much more solid; it tracks better, and control input feels crisp and responsive. I've found that when I switch a model from analog to digital servos, I need to increase the amount of expo. This is good evidence that the digital servos are pushing the surface more positively and aren't allowing the forces of the flight loads to win the battle, and that eliminates the mushy feeling.

Using digital servos has a few drawbacks, though. Digital servos typically cost more than analog servos. The new sport digital servos such as the JR 811, however, reduce that cost differential significantly. The only other issue is that digital servos use a little more battery power than analogs. Because they fight much harder to hold their positions, the motor works harder. That's why digital servos make a high-pitched buzzing sound. The motor is being pulsed at a high frequency, and thus, it works harder and faster. For me, this isn't a big issue; I simply use a slightly larger battery pack.

Regardless of the type of aerobatics you fly, give digitals a try. I'm willing to bet that you'll never look back.

—Mike McConville

JR servos are a very popular choice among competition and sport fliers alike. The 8231 features tremendous holding power compared with a standard analog servo, and it has 5,900 steps per 120 degrees of resolution. It is ideal for pattern ships, helis, or jets.

To satisfy the power requirements of digital servos, you can use various types of power supplies that range from Airtronics' more powerful, standard-size Ni-Cd 1100mAh to the larger Extra 3000mAh Ni-Cd from JR. For longer flight times, trying using lithium-ion batteries from Duralite or Li-poly batteries from manufacturers such as Multiplex.

Pump it up!

DIGITAL SERVOS' POWER CONSUMPTION IS A DRAWBACK; to supply their remarkable precision and holding power, digital servos use more power than standard servos. Although it isn't a significant disadvantage, it's something to be aware of.

Once you've made a decision to use digital servos in your aircraft, keep in mind that you'll need more battery power. You could use one larger battery or separate power supplies for each group of servos (easily done if you use JR Matchbox or Futaba MSA-10 servo-matching systems). Using a 6V power supply (5-cell NiMH or Ni-Cd) would be preferable to using 4.5V (4-cell) batteries. Li-polys and Li-ions are also excellent choices for power, but their output voltage will have to be brought down to 6 volts with a regulator.

It's a good idea to add an onboard battery monitor to check the battery's condition. At the very least, you should have easy access to the batteries so that you can check their power levels with a hand-held meter. Buy a 12V battery charger for the type of cells installed. In that way, the batteries can be topped off just before the flight and guarantee the maximum power reserve.

As you can see, the one downside to using digital servos (other than cost) is easily overcome. With the proper power supply and monitoring, digital servos provide precision, solid control and safety to models of any size.

Futaba is no stranger to high-quality radio gear and servos. Its new S-series of digital servos continues the tradition. The massive S5050 delivers 264 oz.-in. of torque, while the S9152 provides an impressive 278 oz.-in. of torque; both come with metal gears.

This same programming advantage can be used when you "gang" digital servos together for a single control surface. You can custom-tune digital servos so that they all have identical movements, and that allows the servos to be slaved together for a common task without their fighting over the neutral position. This will prevent unnecessary draining of the airborne battery pack.

The JR Matchbox and Futaba MSA-10 allow you to synchronize up to four servos so they move in harmony with one another. This is important when using two digital servos on one control surface because if they are not synchronized, they will quickly drain the flight battery.

Working together

WITH THE TREMENDOUS HOLDING POWER THAT DIGITAL SERVOS have, you might think that there would be no reason to use more than one of them on any control surface, but you would be wrong. Many available models are so large (or have such large control surfaces) that the only way to achieve a safe positive control is to gang up the servos on each control surface. Because of their precise response to control-stick inputs, digital servos are the perfect choice when you have to use more than one servo on a control surface.

When you have multiple digital servos on a control surface, each servo must be precisely matched to the other to minimize excessive draining of the flight batteries because the servos will fight each other if their travel points are different. To achieve this harmony amongst the servos, you can use devices such as JR's Matchbox or Futaba's MSA-10.

The Matchbox and MSA-10 allow you to synchronize the neutrals, endpoints and servo direction of up to four servos from a single receiver channel. Precision control of each servo's movement guarantees that all the servos on a single control surface will work together efficiently and in harmony. These servo-matching systems allow each set of servo groups to have its own independent power source (battery), and that allows all the power from the main flight battery to go directly to the receiver.

To minimize the number of servo leads and their length, the Matchbox and MSA-10 can be mounted close to the control surfaces. Each servo plug can go into the servo-matching system, and then, just one servo wire is connected from the Matchbox or MSA-10 to the appropriate receiver port. This eliminates the massive clutter of wires that snake their way through the inside of the aircraft to the receiver.

If your plane requires multiple digital servos for each control surface, servo-matching systems will make installation easier and allow all of the servos to work in concert.

Airtronics offers a complete line of digital servos. Available with plastic or metal gears, these servos can be operated on 4.8 to 6 volts and range from 73 to 115 oz.-in. of torque.

This is just a sample of the advantages offered by digital servos, and we've only scratched the surface of the Hitec Digital Servo Programmer HFP-10's programming capabilities!

ARE DIGITAL SERVOS FOR YOU?

Many non-digital, high-torque/high-speed servos are available, and they may meet your plane's needs without your having to switch to digital servos. If you're on a tight budget, it makes sense to continue using standard servos. Standard servos are also a better choice for control surfaces that tend to jam, such as flaps, retracts and spoilers. A jammed digital servo will quickly deplete battery power and will add significant stress to all of the linkages. Don't use a high-powered digital servo to overcome a binding linkage; the servo will simply fight with full power trying to overcome the bad linkage setup.

Use digital servos when you need precision control or better holding power. If you need higher torque in a small servo, digital servos are a good choice. Just remember: the faster the model flies or the larger the control surfaces, the more you will benefit from using digital servos in the plane. Ask any pilot who has used digital servos; he will tell you to switch.

See the Source Guide on page 151 for manufacturers' contact information.

BY GERRY YARRISH
PHOTO BY DERON NEBLETT

DESKTOP AVIATION AT ITS BEST

"Flying" the Ikarus Aerofly Professional Deluxe

IN TODAY'S PC-, CD- AND DVD-FILLED WORLD, IT'S TOUGH TO REMEMBER A TIME when there weren't any RC aircraft flight simulators. Almost 20 years into this virtual wonderland, we almost take them for granted; they're viewed as a fully established part of our hobby. There is a plethora of flight simulators to choose from, and each has its own distinct flavor and style. Compared with the programs we used just a few short years ago, the newest generation of sims is simply amazing. The Aerofly Professional Deluxe from Ikarus is one of the newest, and it has a lot to offer.

At a glance, this impressive flight sim offers more than 50 extremely well-detailed aircraft to fly, and that includes 3D aerobats, turbine-powered jets, scale and sport airplanes, biplanes, gliders and helicopters. Aerofly offers many enjoyable landscapes in which to fly, such as club flying fields, farm pastures and even the deck of the aircraft carrier USS *Enterprise*. If you like what you've read so far, hold on; there's a whole lot more to see. Let's take these virtual airplanes for a spin!

This turbine-powered Learjet is a blast to fly! No fear of damaging an expensive Model Specialties aircraft here; the model looks, sounds and reacts just like Mark Frankel's older Top Gun-competing Learjet 35A!

GET CONNECTED

Getting your ticket for this first-class flight sim is as easy as dropping the CD into your PC and hitting the install button; the Install Wizard takes care of everything. Once you have the program installed, plug in the USB cable, attach the adapter plug that matches your transmitter and start the sim. Remember to turn your transmitter on! I used a Hitec Optic 6, and it worked perfectly. From here, it's all about the menus.

The main screen has several options to investigate. At the top of the list is the Aircraft button (there are actually two aircraft buttons, so you can fly with someone else if you like, as long as you have a second controller). When you click the button, it brings up a screen that features 35 airplanes, 5 gliders and 15 helicopters to choose from. Each aircraft is shown in the main window, and when you highlight it, a small description that provides the model's basic information is displayed. You can also edit the aircraft's specifications and add your own setups to the list of choices.

The scenery button brings you to the environment-selection screen. There are 14 locations that range from club flying fields and farmers' pastures to airstrips in the Alps complete with rustic log cabins. You could also choose a full-size airport or an indoor basketball court complete with scoreboard, ceiling beams and bleachers—the perfect setting for flying the many electric slow flyers available. "Sparling Field" is my favorite: it's a dead ringer for my local club facility, and it's complete with safety fences, parking lot and a pit area.

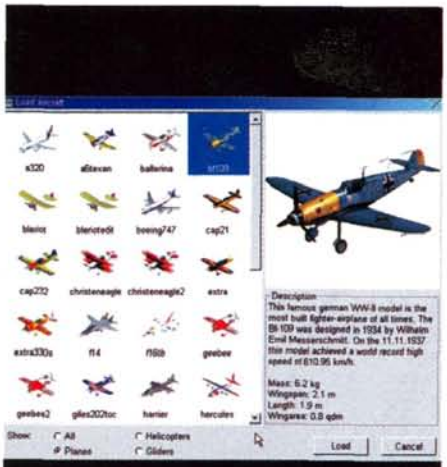
CONTROL SETUP & LOCATIONS

Being able to use your own radio with the sim is a great feature. It allows you to adjust the controls with your radio's own menu or go to the Controls screen and assign the channels and control directions. With multiple channels, controls such as flaps and retracts are available to you. Simple things, such as using the servo-reversing switches and dual-rate switches on your transmitter, make Aerofly feel very real. If you have enough channels, there's even a function that controls the sweep-back action of the F-14 Tomcat's wings!

The amount of control you have isn't limited by the radio you use; the General Options menu allows adjustment for wind speed and turbulence (including thermal action), surface roughness, the operational speed of the sim itself, playback speed, the restart time after a crash (from 1 to 60 seconds and much more).

On the help screen, you'll find useful shortcut information. The keystrokes quickly bring up information sub-windows and different views. You can view the model from a fixed point on the ground, from the cockpit and in follow mode (where you view the model from a chase-plane vantage point). The follow window is also great for exploring the various virtual landscapes available in the program.

There's a lot more to see besides the confines of the local flying field. You can fly through city blocks and between skyscrapers, through and under bridges, over and under highway overpasses and between trees; you can even land on top of



The aircraft-choice window shows all the models, so you just point and click on the one you want. The aircraft you select appears in a larger-view window with a brief description.

SPECIFICATIONS

IKARUS AEROFLY PROFESSIONAL DELUXE
MANUFACTURER: IPACS
DISTRIBUTOR: Ikarus USA
FUNCTION: RC flight simulator for home PC
PRICE: $179 (CD with USB cable and transmitter adaptor plugs); $229 (including USB game Commander joystick controller); $79.95 (Aerofly Pro Update—cables and CD exchange required)

MINIMUM COMPUTER SYSTEM REQUIREMENTS

- Pentium III/4 or AMD Athlon/64 processor with at least 1GHz
- 128MB RAM
- 1GB free hard-drive memory
- Windows 98/ME/2000/XP with DirectX version 9.0 or higher
- DirectX sound card
- CD-ROM drive
- Open GL Graphic card with at least 64MB
- 1 free USB port
- 1 transmitter with a trainer output socket

RECOMMENDED SYSTEM

- Pentium 4 or AMD 64 processor with at least 1.5GHz
- 512MB
- Open GL graphic card with at least 128MB

SIMULATOR TESTED WITH

- EPOX 8ROA Athlon Processor with 2100MHz+
- Windows XP Pro
- 512MB DDR
- 52X/24X/52X CD-ROM
- GeForce Ti4200 AGP video card with 64MB

COMMENTS

The Ikarus Aerofly Professional Deluxe is a great flight simulator with many impressive features and functions. Out of the box, most of the program's model airplanes have a totally convincing, realistic feel.

The aerobatic Christen Eagle biplane is one of my favorites. It's just one of the many aircraft that are featured in the Aerofly flight sim.

This close-up shows the surface-reflection qualities of the Gee Bee Model R-1 racer. Notice the flight info data window in the lower right-hand corner.

Here's a scene straight out of the movie "Top Gun"! The F-14 Tomcat is a perfect model to fly off the USS *Enterprise* aircraft carrier!

snow-covered mountain peaks. Once you start exploring, it becomes very obvious that a lot of work went into developing Aerofly.

CLOSE UP AND PERSONAL

I think the thing that makes everything seem so real is the program's attention to detail. The outer surfaces have a reflective quality that changes as the airplane taxis by. The control surfaces move according to your control settings (a little for low rate and a lot for high rates). Some planes have servos and pushrods showing, and the Ikarus Shock Super Star 3D indoor profile flyer even has a prop protector complete with small rubber band to hold the prop in place. When you're at a flying field, you can taxi up to the pit area and see things like the sign over the clubhouse door and a field box on a work table. The detail is everywhere, and that includes the hangar deck of the aircraft carrier! And yes—you can even fly your model into and through it! Another very convincing detail is how your model reacts to surface roughness. When you taxi the model, there are little jolts and bounces that look totally real. I love it!

ADD SOME RAZZLE-DAZZLE

So, what else can you do with this impressive package of VR RC? Well, there are several neat special features you can try out for size. In the View menu, the Trace option paints a very long translucent ribbon behind your airplane as it flies. I thought this was a great visual aid that shows you where you have already been. If you want to fly maneuvers in an aerobatic box, you're able to see exactly where your last heading was in relation to your entry and exit points! How about smoke? Sure, we got smoke; you can even change its density and color! 3D maneuvers such as hovering and torque rolls are also possible.

Here, our virtual pilot hovers the Three Dee inverted.

The Raptor 30 is a great heli for learning the basics of hovering.

The Chopper Connection

LEARNING TO FLY A HELICOPTER OR TRYING NEW MANEUVERS can be a time-consuming and expensive venture. When machine and earth meet for an unscheduled arrival, the dirt always wins. Enter flight simulators, which have evolved from primitive wire-frame models that flew against a stark blank background to what they are today: highly detailed models that fly exceptionally well in a variety of realistic venues.

Aerofly Professional Deluxe (AFPD) has taken the flight-sim world by storm, and after I logged some hours on it, it was easy to see why. AFPD offers 15 helis that range from the fixed-pitch Piccolo Fun micro heli to multi-blade scale ships to all-out 3D-capable mounts. No flight sim can completely capture the actual RC experience, but AFPD comes very close—especially with helicopters. Let's take a look.

After I loaded the program but before I started to fly, I had to assign the channels to match my transmitter. You'll find the channel-assignment screen under the Control option on the main menu. I used a Futaba 9C, and this procedure was pretty straightforward. Next, click the Advanced button on the bottom of the window and activate the heli-specific functions such as cyclic, pitch, tail rotor, etc. With this basic setup, you're ready to fly; however, if you want to maximize the flight sim's capabilities, you have to go one step further. At the top of the Advanced menu screen are four bar graphs that move in sync with the throttle stick. Disable numbers 2, 3 and 4 by changing the default value from 100 to 0. Doing that allowed me to use the radio's idle-up throttle-curve programming. Now you can fine-tune the virtual model's performance by using the programming features available in your transmitter.

I flew all of the available helicopters and found all of them to be fun to fly and realistic. They can be grouped in three categories: scale, electric-powered and aerobatic/3D. All six of the scale machines have that characteristic heavier feel to them, and if you've ever flown a scale heli, you'll feel right at home. Two of the scale helis, the Eurocopter EC135 and the MD900 Explorer, have flybar-less, multi-blade heads. Most multi-blade helis tend to pitch up in forward flight and when exiting turns. AFPD minimizes this tendency, and that makes the helis a lot easier to fly. My favorite scale heli is the MD900 Explorer; it's stable and solid, and it can do mild aerobatics if you're so inclined.

If you like scale helis, the MD900 Explorer will really whet your appetite.

If you're into electric power, AFPD has you covered; it offers four models, including the popular ECO 8. It's available in a brushed-motor version and, for more skilled aerobatic pilots, a brushless option is available. Here's a tip to get the most performance from the electric helis, especially if you plan to do aerobatics: access throttle-curve idle-up 1 or 2 in your radio's programming, and change all of the points in the curve to 100 percent. Now when you do maneuvers, the power won't sag as you apply negative pitch.

For all-out 3D antics, there are five models to choose from—all sparkling aerobats. If you're a fan of the Raptor 30, you're in luck; AFPD's rendition is very good. For the big boys, you can choose from Miniature Aircraft's flagship The Fury or Robbe's popular Millennium 60. My favorite, though, is the Three Dee; if the actual model flies anything like the virtual model, I want to get one! Talk about outstanding performance, this heli can do it all! I learned very quickly how to do maneuvers with this heli that I couldn't do with other helis on other flight sims. What more can I say?

As you can see, Aerofly Professional Deluxe has a lot going for it. The models look and feel great, and I really like using my own transmitter to program and adjust the models' flight characteristics. I can't wait to amaze my flying buddies with the new tricks I've learned!

—Rick Bell

What about a little competition? In the Contest menu, you're able to set the scene for a pylon race or a drag race, or a spot landing and balloon-popping contest, and you can adjust the time limits. Go into the Graphic menu, and you can control visual elements such as exhaust, smoke and the aircraft's surface reflective qualities. Add fog and clouds, or change it to rainy cloud cover. For an added bonus, several of the scenery choices are photo-realistic. These do come at a price, though; you can't fly in the follow or the cockpit-view modes.

So there you have it. With the Aerofly Professional Deluxe, you truly are lord and master of all you survey! You can adjust the qualities of the graphics, fine-tune the airplanes to your liking and fly virtually anywhere. For the serious aerobatic pilot who wants to hone his precision or the sport flier who simply wants to fly in the middle of winter, Aerofly Professional has a tremendous amount to offer. It is not only entertaining and exciting but also a valuable learning tool for improving your flying skills. I highly recommend it to pilots of all skill levels. ✈

See the Source Guide on page 151 for manufacturers' contact information.

BY BRUCE SMITH > PHOTOS BY BRUCE SMITH & DERON NEBLETT

EVOLUTION .36NT

A new player in the "more power" game

RECENT ADVANCES IN MODEL ENGINE TECHNOLOGY have enabled designers to capture more performance from less displacement, even when compared with newer engines. Capitalizing on this technological race for the holy grail of power is the new offering from Horizon Hobby—the Evolution .36NT. This engine reestablishes performance boundaries found not only in the .36ci 2-stroke glow-engine class but also in the larger .40 and .46 classes. To further enhance the Evolution .36NT's performance, I selected a variety of one-piece mufflers and tuned pipes from Macs Products and dialed in the right header size, length and tuned-pipe choice for this very potent, scrappy fighter of an engine.

The Evolution .36NT can be taken apart completely using one Allen wrench. The engine's quality is obvious throughout.

SPECIFICATIONS

Engine: Evolution .36NT
Displacement: 354ci
Bore: 0.806 in.
Stroke: 0.695 in.
Carburetor bore: 0.295 in.
Practical rpm: 2,000 to 16,000
Weight w/out muffler: 10.3 oz.
Prop-shaft size: ¼-in.x28
Price: $79.99

ENGINE HIGHLIGHTS

- Excellent performance.
- Great packaging.
- Tools included.
- Comes with 2 muffler gaskets and 2 replacement backplate screws.

COMMENTS

The Evolution .36NT is an ABC 2-stroke with a standard muffler with two gaskets and attachment bolts and a hex wrench; a 2-needle-valve carb with high-speed needle assembly at the backplate; a Hangar 9 glow plug; instruction booklet; and a 2-year warranty.

FEATURES

As does the entire line of Evolution engines, the .36NT possesses all of the user-friendly features that make it extremely easy to start and operate. The "Set Right" needle-valve system is the cornerstone of the Evolution line. From the first flip, my test engine ran and kept on running—a first for any ABC engine that I have run to date. Featuring a dual-ball-bearing-supported crankshaft, anodized propeller thrust washer and needle-assembly parts as well as distinctive cooling-fin styling, the .36NT continues to prove that the manufacturer's goal of providing a ready-to-mount-and-fly, dependable and well-made product has been irrefutably secured. All Evolution engines so far have provided a no-hassle experience for modelers.

The stout, nicely counterbalanced crankshaft has a generous intake port opening.

The stock muffler comes with a fuel-system pressure tap.

The piston and bushed conrod are held together by a hollow wristpin that's secured in the piston skirt with a molded-nylon endcap.

The Evolution .36NT comes with a lightweight, reasonably quiet muffler, a Hangar 9 glow plug, a 2-year warranty and a comprehensive instruction booklet.

RUNNING THE .36NT

The .36NT is very easy to start. Attach the fuel line, choke the venturi opening with your finger, and flip the prop several times until fuel fills the line between the remote needle valve and the carburetor. Open the throttle to about ¼ turn, attach the glow driver, and flip the prop again to start. My engine fired up and ran continuously from the very beginning.

The little pin in the end of the "Set Right" needle-valve system limits how much high-end adjustment you can make. It works great!

PORT TIMING

PORT	OPENS (deg.)	CLOSES (deg.)	DURATION (deg.)
Intake valve	34 ABDC	48 ATDC	194
Transfer (1)	52 BBDC	52 ABDC	104
Boost (2)	60 BBDC	60 ABDC	120
Exhaust	74 BBDC	74 ABDC	148

All measurements are from TDC
Key: TDC = top dead center; BDC = bottom dead center; A = after; B = before

The Evolution .36NT was tested with Macs Products tuned pipes and headers (see the chart below for details).

TUNED-EXHAUST SYSTEMS

TUNED PIPES OFFER ANY 2-STROKE ENGINE a substantial increase in power output. The principle is pretty simple: 2-stroke engines are designed to have a certain amount of time—or overlap—when both the intake and the exhaust ports are open. This occurs during the power stroke, or downstroke, of the piston (after combustion). The overlap is designed to use outgoing exhaust force to draw in the next intake charge before the next combustion event. This is also the reason that 2-stroke glow engines spit out a certain amount of unburned fuel, which also helps to cool the engine.

A tuned-pipe system comprises a header pipe, a silicone-tube coupler and the expansion-chamber muffler. The "tuned" aspect refers to determining the header length that enables the engine to obtain the greatest rpm gain. Tuning an expansion-chamber system requires cutting the header's length a little at a time and testing the system for an rpm reading at each interval. Typically, shortening the header raises the rpm until you reach a point at which the rpm reading decreases. That's when you stop cutting.

The performance principle at work with a tuned system is a basic form of supercharging. A tuned-exhaust system creates supercharging by increasing the intake of the engine to a volume greater than it would normally draw in. The "overlap" of the intake and exhaust ports allows this overflow of intake to pass through the engine and partly into the expansion chamber. The sound wave from the previous exhaust stroke travels to the end of the chamber and is then reflected back to the engine, acting like a plunger forcing the over-abundance of mixture back into the engine. The net result is a cylinder that's packed with more combustion mixture than it would obtain if normally "aspirated"—thus, it's supercharged. The tuning of the system is actually "timing" the moment the pressure wave returns to the exhaust port before the port closes for the next combustion event or power stroke. The increased volume of intake charge makes more power—end of story.

My two favorite publications for additional reading on tuned-exhaust systems are "All About Engines" by Harry Higley and "Basics of Model Marine Engines" by Alan Hobbs—published by Air Age Media.

The bottom line on tuned pipes is more power, rpm and fuel consumption.

I tested the engine with Macs Products one-piece mufflers in place of the stock one. The Performance Evaluation Tests chart shows how well they did.

I used the recommended 9x6 prop for the first few runs. Evolution engines are promoted as needing no break-in, and this is true; my test engine's performance was flawless and steady from the get-go, and it had good throttle transition. Nevertheless, you should still run a couple of tanks of fuel through it prior to actually flying your model with it.

PERFORMANCE EVALUATION TESTS

Temperature: 70 deg. F
Humidity: 29%
Barometer: 30.13
Fuel: Wildcat 10% nitro/18% oil (80/20 mix synthetic/degummed castor)
Fuel consumption: 1 oz. per min. (8.75x5 @ 17,650rpm)
Propellers: all APC
Decibels measured at 3 meters

With standard muffler—¾-in.-i.d. exit

Prop	8.75x5	9x5	9x6	9x6N	10x3	10x4
dB	95	95	96	95	96	95
Rpm	16,900	16,350	15,200	16,650	16,050	14,550

With Macs Products muffler no. 6340 for .21 to .38 engines

Prop	8.75x5	9x5	9x6	9x6N	10x3	10x4
dB	96	96	94	95	96	95
Rpm	16,410	16,020	15,150	16,620	16,350	15,350

With Macs Products muffler no. 6650 for .35 to .46 engines

Prop	8.75x5	9x5	9x6	9x6N	10x3	10x4
dB	97	96	94	95	97	93
Rpm	16,500	16,250	15,300	16,350	16,320	15,150

With Macs Products header no. 2650 for .40 to .44 engine & Macs tuned pipe no. 1230—6.5cc

Prop	8.75x5	9x5	9x6	9x6N	10x3	10x4
dB	95	96	96	96	96	94
Rpm	17,700	16,680	15,300	17,160	16,950	15,120

Note: ½ in. removed from header.

The main carburetor body and the remote high-end needle-valve assembly are connected by a short piece of fuel tubing. The needle valve is held in place with two of the backplate bolts.

> **The .36NT** belts out impressive performance numbers

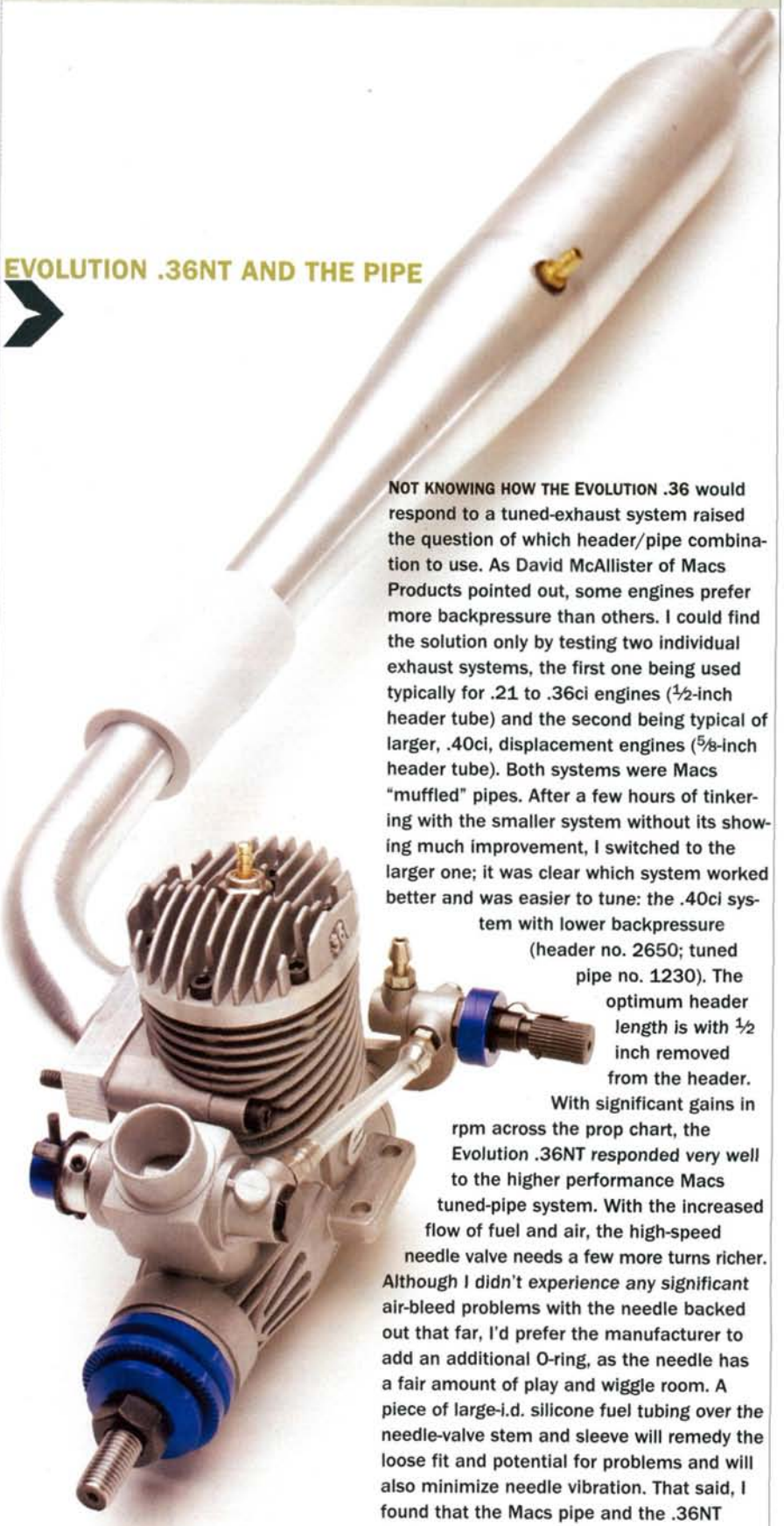
The .36NT's performance is impressive and exceeded my expectations. For my evaluation, I selected a variety of APC propellers and very carefully balanced them all. As the performance tables with the standard muffler suggest, *the .36NT cranks up some pretty* high revs, and changing to a tuned-pipe system opens the envelope even wider. In addition to testing the engine's tuned-exhaust performance, I wanted the Macs one-piece *mufflers to prove their merit. I used two* Macs mufflers of different volumes and dimensions, but they had the same attachment-bolt spacing. The smaller one (item no. 6340) is designed for .21 to .38ci engines, *and the larger unit (no. 6650) is suggested for* .36 to .46 engines (refer to the Performance Evaluation Tests chart). These mufflers are a great alternative to the stock unit and offer similar performance as well as low noise, *lighter weight and economy of design*—all wrapped up in a trick matte-black finish.

FINAL THOUGHTS

The .36NT belts out impressive performance numbers with both short and long (low-pitch) propellers, so it's a great choice for fun-fly, sport, aerobatic and Quickie 500 designs. Run it with the stock exhaust or the tuned-exhaust system, *and for the price, I* think you'd be hard-pressed to find an engine of any displacement that can match the Evolution .36NT. I like the tuned-pipe option, but again, that's me. You decide!

See the Source Guide on page 151 for manufacturers' contact information.

EVOLUTION .36NT AND THE PIPE



NOT KNOWING HOW THE EVOLUTION .36 would respond to a tuned-exhaust system raised the question of which header/pipe combination to use. As David McAllister of Macs Products pointed out, some engines prefer more backpressure than others. I could find the solution only by testing two individual exhaust systems, the first one being used typically for .21 to .36ci engines (½-inch header tube) and the second being typical of larger, .40ci, displacement engines (⅝-inch header tube). Both systems were Macs "muffled" pipes. After a few hours of tinkering with the smaller system without its showing much improvement, I switched to the larger one; it was clear which system worked better and was easier to tune: the .40ci system with lower backpressure (header no. 2650; tuned pipe no. 1230). The optimum header length is with ½ inch removed from the header.

With significant gains in rpm across the prop chart, the Evolution .36NT responded very well to the higher performance Macs tuned-pipe system. With the increased flow of fuel and air, the high-speed needle valve needs a few more turns richer. Although I didn't experience any significant air-bleed problems with the needle backed out that far, I'd prefer the manufacturer to add an additional O-ring, as the needle has a fair amount of play and wiggle room. A piece of large-i.d. silicone fuel tubing over the needle-valve stem and sleeve will remedy the loose fit and potential for problems and will also minimize needle vibration. That said, I found that the Macs pipe and the .36NT were a sweet combination!

One of the special features of the author's scale models is their sliding canopies. They add a lot of realism.

MAKING SLIDING CANOPIES

BY VANCE MOSHER > PHOTOS BY VANCE MOSHER & DERON NEBLETT

ONE OF THE FIRST THINGS PEOPLE LOOK AT on a scale model is its cockpit. Anything that makes the cockpit look more realistic contributes greatly to the model's realism. And, of course, a sliding canopy does that; so let's make one. Real airplane canopies have metal frames to make them strong and rigid, but this usually isn't necessary with models. Molded canopies are stiff enough, and canopy frames are required only when you are making a super-scale or giant-scale plane. Since we aren't installing frames, we'll just talk about making the sliding parts.

Photo 1
The parts needed for a canopy slider are a base strip (balsa), one I-beam section and two C-beam sections. These plastic sections are available from Plastruct.

Photo 2
Use CA to glue the first C-beam to the balsa base strip.

Photo 3
With the slider removed, you can permanently glue the second C-beam into place; then trim the base flush with the plastic parts.

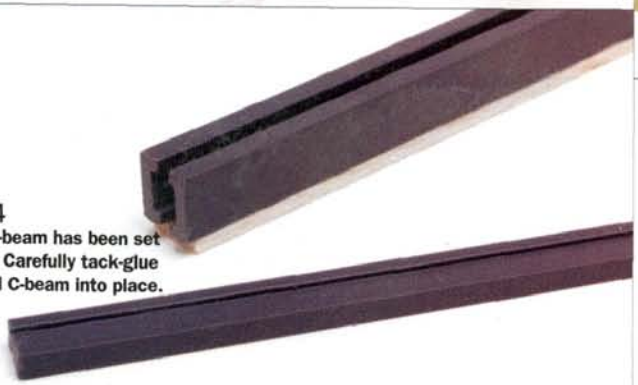


Photo 4
Here, the I-beam has been set into place. Carefully tack-glue the second C-beam into place.

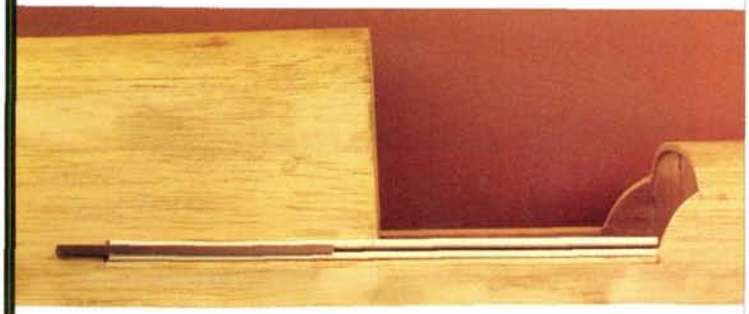


Photo 5
This shows the slider and channel assembly glued into place in the model.

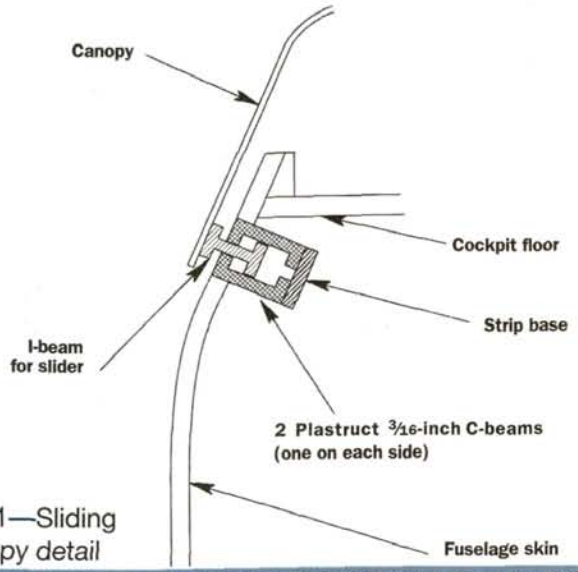


Fig. 1—Sliding canopy detail
Sliding canopy channel and rail slides made from Plastruct pieces are available from model train hobby shops.

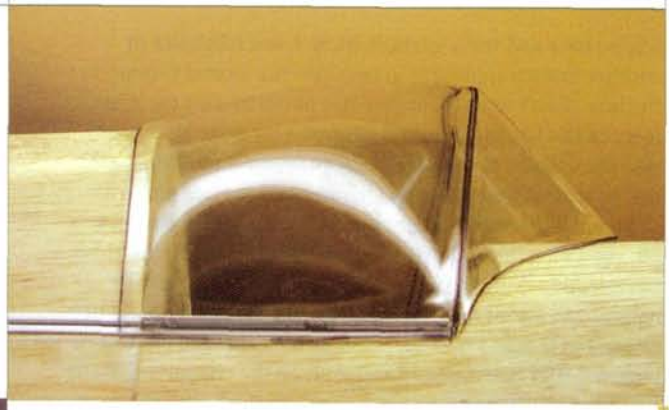


Photo 6
With the sliders in the forward position, the canopy has been glued into place.

For this technique, "Goop" glue works well. This common variety store adhesive is sold under a bunch of names, such as "Household Goop," "Plumber's Goop" and "Shoe-Goo." It's all the same stuff, and any brand will work. Zap's "Zap-A-Dap-A-Goo" is somewhat thinner, and I prefer to use that, as it is easier to apply in precise amounts.

Note that the canopy slides shown angle upward a bit at the rear so the canopy lifts up and away from the fuselage slightly when it is slid back. The fuselage also narrows toward the top, so the slides (which are parallel to each other) stick out of the fuselage a bit at the rear. This is intentional. The canopy can be removed by pulling the sliders all the way out of the rear of the channels. I use a removable stop at the rear of the channels to prevent the canopy from falling off during flight.

The canopy channels on some aircraft don't stick out of the fuselage sides and, thus, can't slide out. If you want the canopy to be removable, you'll have to screw it to the sliders instead of gluing them on. Full bubble canopies usually use slide channels that point upward.

FABRICATING SLIDES

I make my slides and channels out of Plastruct, a material that's available at most model-railroad hobby shops. Molded of plastic, these structural shapes are available in a variety of shapes and sizes. Plastruct comes in black ABS and white styrene. The black ABS pieces tend to be stronger and easier to disguise. The shapes used here are 3/16-inch I-beams and C-beams. It's advisable to use CA when you glue Plastruct.

STEPS FOR INSTALLING SLIDES

Select a base to glue the plastic parts to; this will make assembly easier. The piece shown is 1/16-inch-thick by 1/4-inch-wide balsa cut to the desired length of the canopy slide. All of these dimensions will vary according to the size of your aircraft. If you don't want to use balsa, Evergreen Scale Models makes strip styrene in a wide range of sizes, and it's perfect for making the base strips (see photo 1). Using glue sparingly, glue the first C-beam section along one edge of the base strip with the open side toward the center of the base (see photo 2). Nest the I-beam slide in the open side of the C-beam, and place the second C-beam on the base with its open side toward the slide. This captures the slide between the two C-beams. Do not squeeze the slide tightly between the two beams. Slide the

I-beam back and forth to check its fit. Use a toothpick or another fine-tip applicator to tack-glue the second C-beam to the base. Don't use a lot of glue (see photo 3). Test the movement of the I-beam slide, and remove it for now. Now firmly glue the C-beam to the base. Trim away any part of the base that protrudes past the outer channel sections (see photo 4).

Measure the width of the base and both sides of the cockpit; cut a long slot in the fuselage side sheeting to fit the channel assembly. Cut the canopy I-beam sliders to the correct length, and install them in the channels. This isn't always necessary, but it might be if the slides in your airplane can't be removed later (see photo 5). Carefully fit the channels into the fuselage slots so that their outer edges are flush with the fuselage sheeting. Hold them in place with pieces of tape or several angled pins pushed into the fuselage.

Carefully glue the channels to the sheeting. Use a fine-tip applicator, and let the glue wick into the joint between the wood and the channels. Don't get any glue on the sliders (see Figure 1).

To protect their surfaces, cover the outer faces of the sliders where the canopy will be glued to them with masking tape. You can now paint your model. Don't get any paint down in the channel, though. Glue the canopy onto the sliders. Cut a slit that's a bit longer than the sliders in two pieces of wax paper and fit them between the sliders and the channels. This will prevent the canopy glue from getting into the channels. Move both sliders to their forward positions, and test-fit your canopy to make sure that it will fit properly against the windshield and the aft fuselage. Remove the masking tape from the slider faces and apply some Goop. Fit the canopy over the sliders, and hold it in place with tape until the glue has dried. Set the model aside for a couple of hours (see photo 6). Remove the tape and the wax paper, and then—when no one is watching—slide your canopy back and forth as much as you like (see photo 7).

There; see how happy your pilot looks now that he can get out of the airplane? Adding a sliding canopy to your model increases its scale appearance and is a great way to add some excitement to your model. It isn't all that difficult; give it a try!

See the Source Guide on page 151 for manufacturers' contact information.

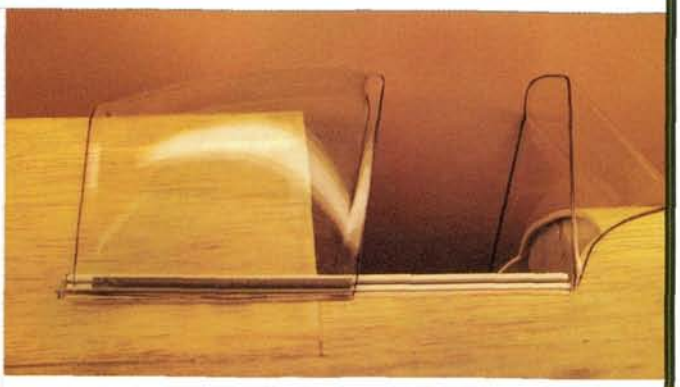
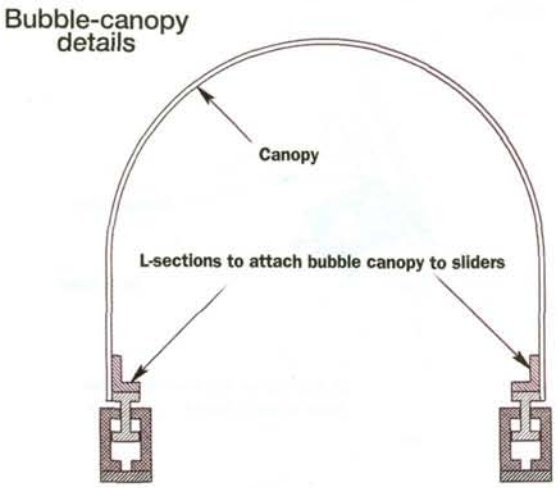


Photo 7
Because of the slight upward angle of the sliders, as the canopy is slid back, it moves slightly up and away from the top of the fuselage.

Photo 8
This is one happy pilot!

BUBBLE-CANOPY RAILS

For a full bubble canopy, you will need one more part. Cut a piece of L-beam to the same length as the slider, and glue it to the top of the slider with its vertical portion facing outward. Some aircraft, such as the T-28 Trojan, have a canopy channel that also runs down the top centerline of the rear fuselage just behind the canopy. This requires a third channel and slider set. This slider requires that a hard, wooden wedge be glued to its top to match the shape of the inside rear of the canopy. All three sliders can either be glued in or attached to the canopy with screws.



With most bubble canopies, the channels (facing upward) can simply be glued to the inside or the top outside edges of the cockpit opening.

The Art of **Aircraft Trimming**

8 STEPS TO MAXIMIZE YOUR MODEL'S PERFORMANCE

BY RICK BELL

Nothing flies better than a well-trimmed aircraft, as this Hangar 9 Aresti 40 demonstrates.

> "No matter how straight you build your model, IT WILL LIKELY NEED MINOR TRIM TWEAKS"

TO FLY CORRECTLY, an airplane must be in proper trim. Flight-trimming involves making many flights and observing your plane's reactions in various situations. By making corresponding adjustments, you're attempting to make the plane fly neutrally. In other words, if you apply right rudder while flying straight and level, the plane will yaw to the right and not show any tendency to dive or climb. Though this is the ultimate goal, it's often very difficult to achieve because of many factors—primarily, the model's design. It is, however, possible to minimize design faults considerably by making subtle trim changes, radio mixing corrections and center of gravity (CG) adjustments.

All trim flights should be made in calm conditions, and all maneuvers must be entered dead-on straight and level. If the entry isn't level, the maneuver will be skewed, and you'll misinterpret what the plane is doing. Having an observer carefully watch the plane is extremely helpful, as he can provide real-time feedback. Do each maneuver several times to make sure that a small gust of wind isn't affecting it.

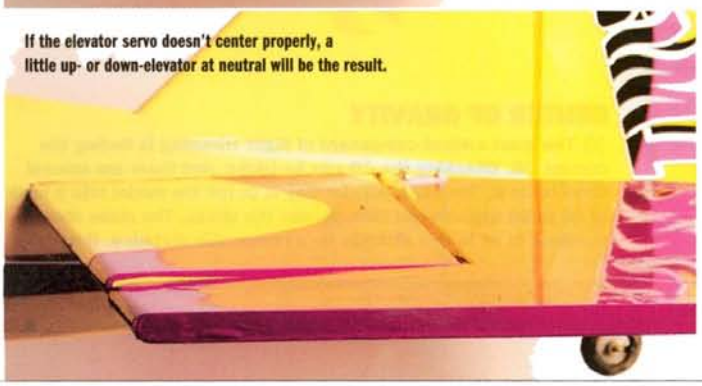
Throughout the process, you'll make several flights, and it's important to change only one thing at a time and to test the plane after each change. Following are eight ways to recognize—and solve—any problem that you might encounter.

CONTROL CENTERING

During the initial flights, you should check the controls for centering. Perform several loops and rolls. Does the plane return to straight-and-level flight or does it wander? If it wanders and never returns to a locked-on neutral, there could be a binding, or a stiffly moving pushrod or a servo that never returns to the same true center. Maybe the control surfaces aren't centered when at neutral. Investigate, and correct as necessary.

1

Here, the elevator is in the neutral position. Compare this with the photo below.



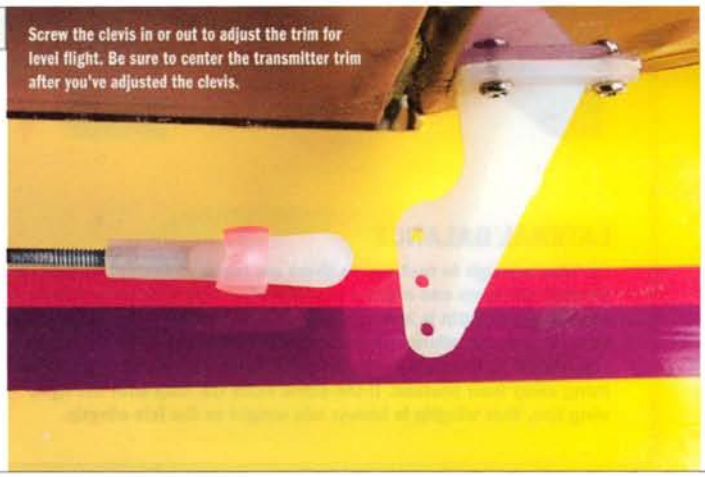
If the elevator servo doesn't center properly, a little up- or down-elevator at neutral will be the result.

CONTROL NEUTRAL

No matter how straight you build your model, more than likely, it will need some minor trim tweaks to make it fly level. Obviously, the straighter the model is built, the fewer trim adjustments it will need.

Fly the model straight and level, let go of the sticks, and observe what it does. Adjust the transmitter trims to correct any deviation from straight and level, and land the plane. Adjust the clevises to move the control surfaces to match the transmitter trims, and then center the trims. Fly the model and repeat the tests until it will fly hands-off straight and level with the trim levers centered.

2



Screw the clevis in or out to adjust the trim for level flight. Be sure to center the transmitter trim after you've adjusted the clevis.

3

You can change how much the control surfaces move by adjusting the endpoints in your computer radio or by moving the pushrod inwards or outwards on the servo arm and control horn; moving it inwards on the servo arm reduces throw. It works in the opposite way on the control horn.

CONTROL RESPONSE

Fly the plane around and perform random maneuvers. Is the model oversensitive (jerky) to control inputs, or does it feel sluggish? If it's touchy, reduce the throws at the servo or the control surfaces, or by dialing down the throw in the radio programming. If you like the way the model feels but it is still a bit twitchy, dial in a little exponential to soften the control response around neutral. Do the opposite if the model feels sluggish. Be aware that the CG can also affect the way the model "feels." Chances are that if the CG is toward the rear, control response will be more sensitive—especially elevator.

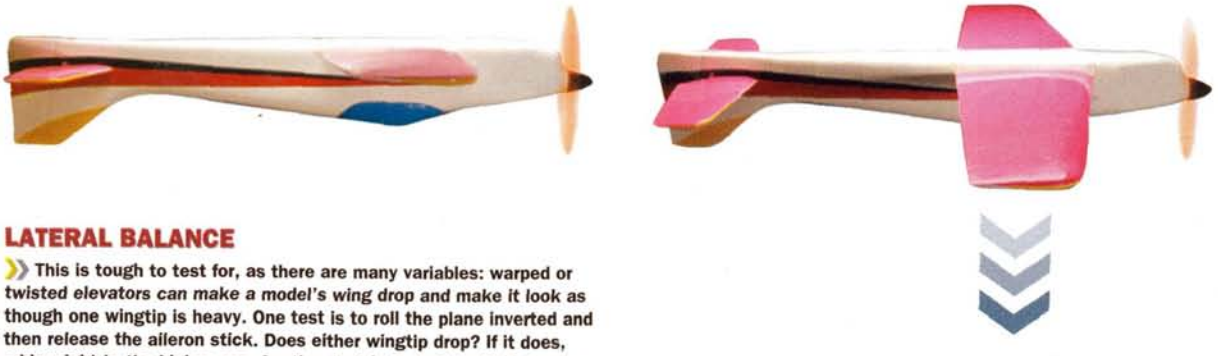
As a rule, I like my planes to perform three rolls in 4 seconds on high rates and three rolls in 6 seconds on low rates. For elevator, I like the model to do a 150-foot-diameter loop on low rate and loop as tightly as possible without snapping out on high rate. I use rudder high rate for crisp stall turns and low rate to hold knife-edge flight. I make these adjustments one at a time until the control response is what I want. Take your time here, as it can really make a difference.

4

CENTER OF GRAVITY

» The most critical component of flight trimming is finding the correct CG. Checking the CG can be tricky, and there are several ways to do it. The most popular way is to roll the model into a bank of 45 to 60 degrees and then release the sticks. The plane should continue to fly in this attitude for a reasonable distance. If its tail drops, the CG is too far aft; move it forward by moving the battery (if possible), or add nose weight. If its nose drops, do the opposite. Use only the ailerons to establish the bank; don't touch the elevator, and do the bank in both directions to ensure that you're reading the CG accurately.

5



LATERAL BALANCE

» This is tough to test for, as there are many variables: warped or twisted elevators can make a model's wing drop and make it look as though one wingtip is heavy. One test is to roll the plane inverted and then release the aileron stick. Does either wingtip drop? If it does, add weight to the higher one. Another test is to perform tight loops flying away from yourself. If the plane exits the loop with the right wing low, that wingtip is heavy; add weight to the left wingtip.

6

ENGINE UPTHRUST & DOWNTHRUST

» To put it simply, the engine thrust line controls the plane's vertical uplines, and there are a couple of ways to check it. Method one is to fly straight and level and cut the throttle to idle. If the plane continues in level flight and drops gradually, no change is needed. If it climbs abruptly, reduce the downthrust. If it dives abruptly, increase downthrust.

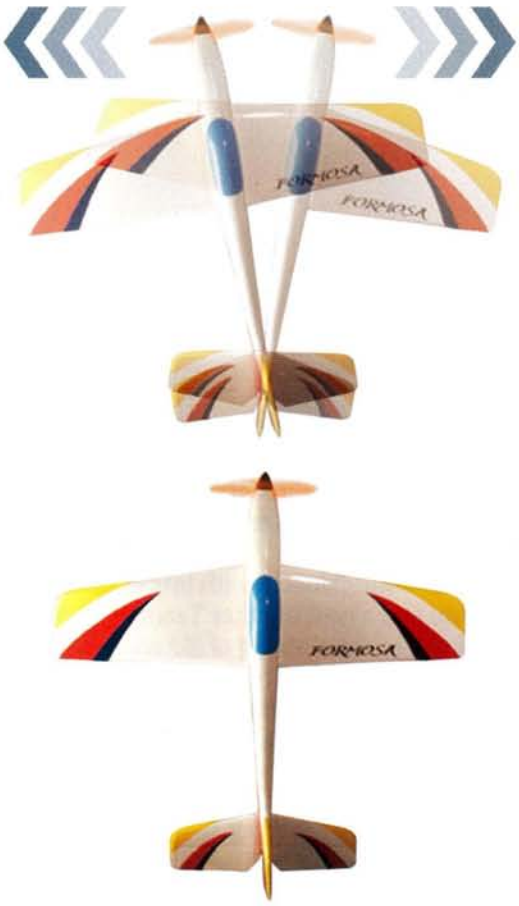
In the second method, again fly straight and level, and smoothly pull into a vertical climb. Does the plane pull towards the canopy or the belly? If it pulls towards the canopy, increase downthrust. If it pulls towards the belly, reduce downthrust.

> All TRIM FLIGHTS should be made in calm conditions, and all maneuvers must be entered DEAD-ON STRAIGHT AND LEVEL.

7

LEFT & RIGHT THRUST

This test is best done by flying the plane away from yourself and pulling it into a vertical climb. Does its nose veer to the left or to the right? If the nose pulls to the left, increase right thrust; if it pulls to the right, reduce right thrust.



8

ROLL DIFFERENTIAL

Whenever you roll an airplane, the aileron that moves downwards generates more drag than the aileron that moves upwards. This induced drag caused by the down aileron will pull the model's nose off a straight line. In other words, if you roll to the left, the aileron differential will cause the plane's nose to yaw slightly to the right. A simple test is to fly the model towards you and then pull up in a vertical climb. Neutralize the controls and perform a half-roll. Did the model's nose change its heading to the direction opposite that of the roll or in the same direction as the roll? If the change was in the direction opposite the roll, increase aileron differential. If the heading change is in the direction of the roll, decrease aileron differential.

PARTING THOUGHTS

These trim tests are the most common ways to get the most out of your model. Aircraft trimming is a constant process. Every time you change something, there is a chance that it will affect something else. Just stick with it and understand what's happening and why. The process isn't difficult, but it is time-consuming. Don't be surprised if you fly more than 30 flights to get through this list. Follow these tips and your plane will be easier to fly, and you'll be a better pilot as you really come to understand why your plane flies the way it does. Happy landings!

RCX™

THE BIG SHOW IS BACK!

On May 21 and 22, 2005, Air Age Media and Vision Entertainment will once again host RCX—the world's ultimate Radio Control Expo—at the Anaheim Convention Center in California. The first two RCX events were spectacular, but this year's event promises to be bigger, better and even more exciting, so get your tickets early!

NEW FOR 2005

Top pilots will perform unbelievable 3D aerobatics in two huge Fly Zones where you'll see the latest backyard flyers and micro helicopters up close and in person. The off-road track will have longer straightaways for high-speed action and larger jumps for sick, big-air stunts. The boat pond has been enlarged to allow nitro-burning deep-vees, tunnelhulls and catamarans to churn out wet-and-wild wave action.

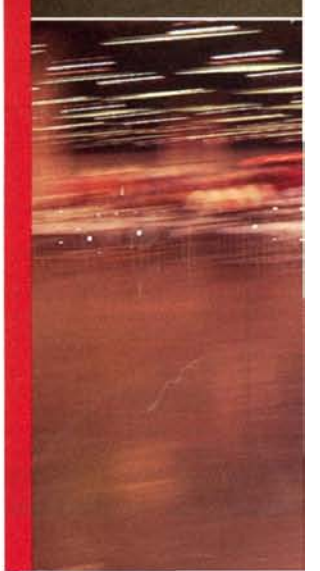
RCX will be a rubbernecking experience unlike any other because full-throttle excitement will be everywhere you look: RC airplanes and helicopters will perform jaw-dropping aerobatic demos; there will be nitro-burning 1/8-scale buggies and monster trucks pulling stunts on the freestyle track; and look for nonstop racing mayhem on Hobby People's "Try Me Track," where you can take the controls for yourself.

You can check out all of the hottest RC products at the RCX Shopping Mall and meet major RC manufacturers, retailers and aftermarket companies. Industry giants such as Ace Hobby, Du-Bro, Great Planes, GWS, Hitec/Multiplex, Hobby People, Horizon Hobby, Kyosho, MS Composit, Tamiya and many more will display their latest gear.

In addition, you won't want to miss the International Die Cast X Collectors Expo that will be held with RCX. Join thousands of collectors, traders and manufacturers at this inaugural event; it promises to be a die-cast lover's dream come true.

We'll be giving away prizes worth big bucks, so get ready to rock at RCX 2005! Tickets are on sale now at rcx.com; log on for all of the latest show info.

—the *Model Airplane News* crew



Top pilots like Jason Shulman know that all-out aerial stunts might damage their airframes, but what's a broken wing when you're performing at the hottest show in town? A little glue, and this 3D aerobat was back in business!

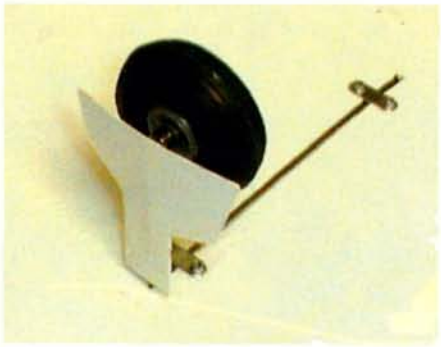
BY RICH URAVITCH > PHOTOS BY RICH URAVITCH

MiniWave EDF

An electric powered jet that really performs!

A QUICK LOOK AT *MODEL AIRPLANE NEWS*—or any other RC publication—over the last several years provides a clear indication of the two most explosive areas of growth in the hobby: almost-ready-to-fly (ARF) planes and electric power systems. ARFs are proliferating faster than rabbits on Viagra, and they're getting better all the time. The electric-power segment is also growing by leaps and bounds, and it has allowed many new fliers to become involved with the hobby. Eventually, some expand their horizons and look to higher-performance models, not the least of which are electric ducted-fan models (EDFs.)

Rich Uravitch poses with a pair of MiniWave EDFs.



Main landing gear is simple and is held in place with straps.

With the MiniWave's split-tail arrangement, the WeMoTec fan unit is simply bolted into place out in the open. Note the ruddervator servo just below the fan on the side of the fuselage.

Huge breakthroughs in propulsion systems, including Li-poly batteries and brushless motors, have enabled us to achieve power and thrust that we simply couldn't get with glow engines. Looking back over my 30-plus years of building and flying ducted-fan jets, I can recall the early anguishes of high-nitro fuel, tuned pipes, blown glow plugs and other impediments to successful ducted-fan operation. EDFs have introduced a level of reliability never before seen in jet modeling.

Those with deep pockets may argue that turbines possess the same qualities, and I'd agree—but those qualities come at significantly higher costs. EDFs are also easier to operate at existing flying fields and require far less support equipment, and that (among other things) drove my development of the MiniWave.

The MiniWave was inspired by Dave Platt's turbine-powered Heatwave sport jet—a no-nonsense, all-wood, easy-to-build model. The same qualities carry over to the smaller MiniWave. In less than a week's worth of spare time, it can be built easily with conventional, off-the-shelf materials that include balsa and lite-ply. But before you jump into this project, please recognize that the propulsion system required for jet-like performance does not come cheap. The fan unit, motor, electronic speed control (ESC) and the brushless motor cost about the same as a .91 glow ducted-fan package. I also caution you that this is a high-performance sport jet that's capable of speeds around 100mph. Exposure to the whine and whistle of the MiniWave during a high-speed pass is likely to hook you; let's get started.

WING CONSTRUCTION

The wing is built upside-down in separate panels over the plans. After you've cut out all the parts, slide the rear portions of the ribs into the slots cut in the main spar, and then slip the front section of the ribs into position. Place the entire assembly over the plans, and glue all of the ribs and spar intersections together. Glue the trailing-edge stock and the tip rib into place. Install the front center rib assembly and the hardwood landing-gear block. Repeat this sequence to build the opposite panel.

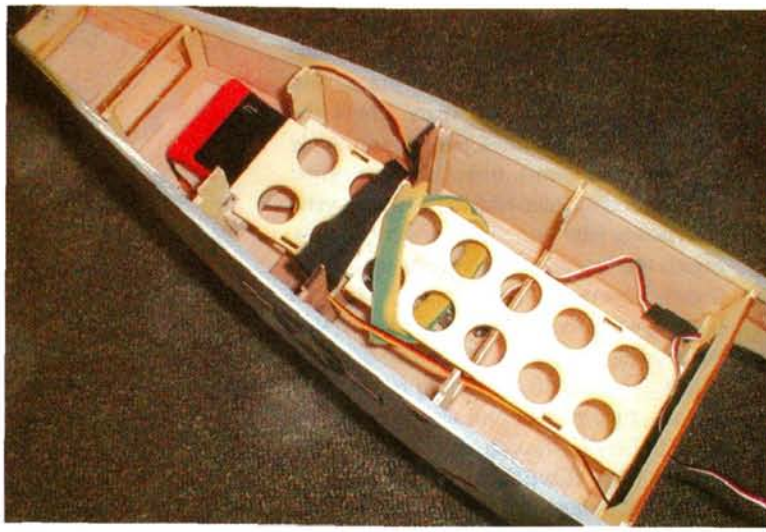
Place both panels over the plans, and temporarily shim them 1/16 inch above the building surface to provide clearance for the

Here, the vacuum-formed fan's inlet ramp is in place to improve intake airflow.

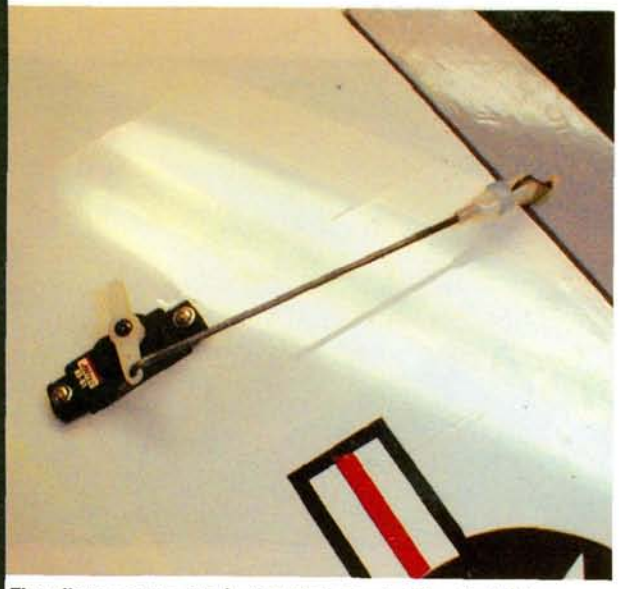
SPECIFICATIONS

MODEL: MiniWave
TYPE: electric ducted fan
WINGSPAN: 48¼ in.
LENGTH: 47 in.
WING AREA: 503 sq. in.
WEIGHT: 78 to 82 oz.
WING LOADING: 23 oz./sq. ft.
MOTOR REQ'D: Hacker B50-9XL, Chili Pepper CP 50, or similar
FAN UNIT: 90mm WeMoTec Midi-Fan
BATTERY REQ'D: 5S (18.5V) Li-poly or 16 NiMH cells
RADIO REQ'D: 4-channel (rudder, aileron, throttle, elevator); V-tail mixing required (retracts optional)

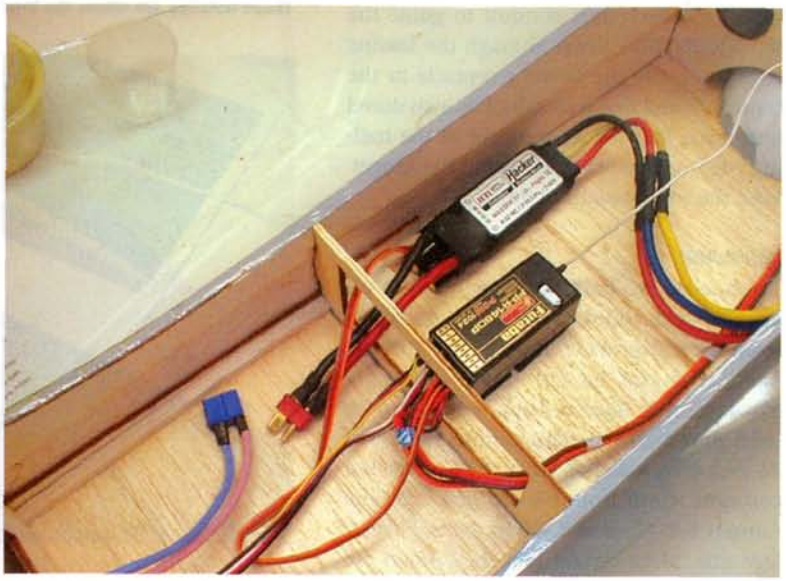
This vacuum-formed canopy can be used to replace the balsa-sheet structure shown on the plans.



With the main hatch removed, you are able to change the flight pack, and you have access to the nose-gear assembly and other onboard equipment.



The aileron servos are in the wing panels. The short linkage run minimizes control-surface play.



There's plenty of room in the fuselage for the onboard radio and power-management gear.

ALTERNATIVE PROPULSION CHOICES

THOUGH THE ORIGINAL MINIWAVE WAS FLOWN USING THE HACKER MOTOR/ESC combination fed by a Thunder Power 5S4P 8000mAh pack, I spent some time looking around for an acceptable system that could offer similar performance yet not put such a dent in the old wallet. My feeling is that although performance costs, and the MiniWave is a high-performance jet—not a park flyer—more of you might be willing to try this exciting form of modeling if less expensive components were used.

The package shown here might be the answer. The system uses the same WeMoTec Midi fan, but it is driven by a preproduction Chili Pepper CP-50 motor controlled by the same Jeti-Hacker 70 ECS. The battery, however, is the new, fourth-generation 5S1P (3250mAh) pack. It fits the MiniWave perfectly, and its compact size allows it to be positioned well forward for balance purposes. The overall weight reduction is significant; the downside is that its capacity is less than half that of the Thunder Power. Nothing for nothing, right?

In static testing, the output appears very similar to the original's, but the proof, as they say, is in the flying; we'll let you know how we make out. There are certainly other options that can be explored; if you decide to build the MiniWave, let us know about your choices and successes.

1/16-inch sheeting that you'll add later. Slide the lite-ply wing joiner into place, and install the 1/4x1/4-inch aft spars. Check the alignment of the joined panels, and apply glue to all the joints. Install the rear center rib assemblies; then add the 1/16-inch balsa sub-leading edge and the front wing joiners. Attach the 1/16-inch balsa leading-edge sheeting and center-section sheeting. Sand the leading-edge sheeting flush with the sub-leading edge, and allow the glue to dry completely. Remove the wing from the building surface, turn it over and add the leading-edge and center-section sheeting. Sand the leading-edge sheeting flush with the sub-leading edge, glue the 3/16x1-inch balsa leading edge into place, and then carve and sand it to shape.

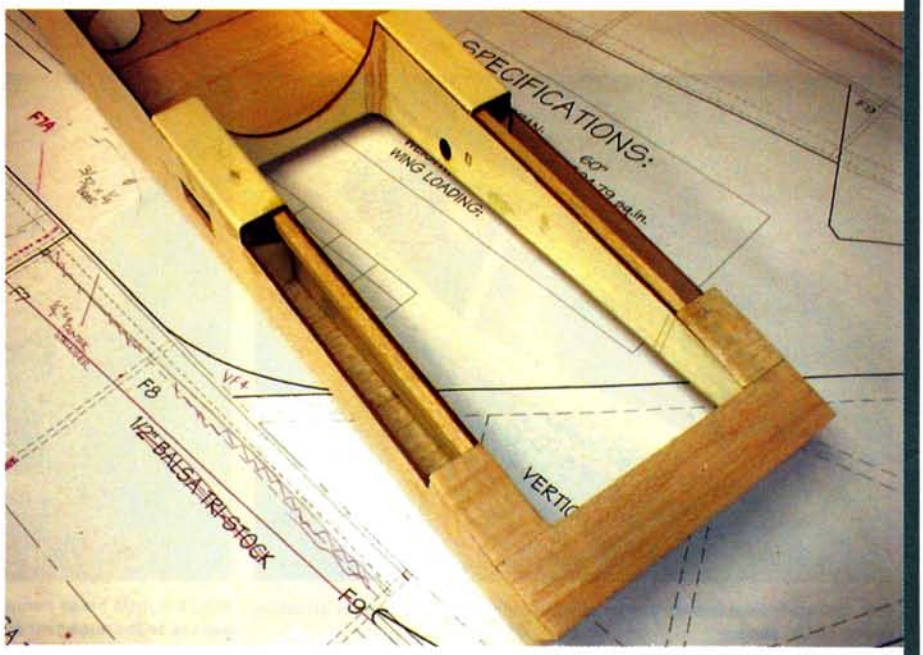
Glue the aileron-servo rails into place, and install a rolled-paper conduit to guide the servo leads. Drill a hole through the leading edge to expose the dowel receptacle in the center rib, and glue a length of 1/4-inch dowel into place. Cut the ailerons out of the trailing edge, and temporarily install the hinges. Sand the wing smooth to finish it.

FUSELAGE

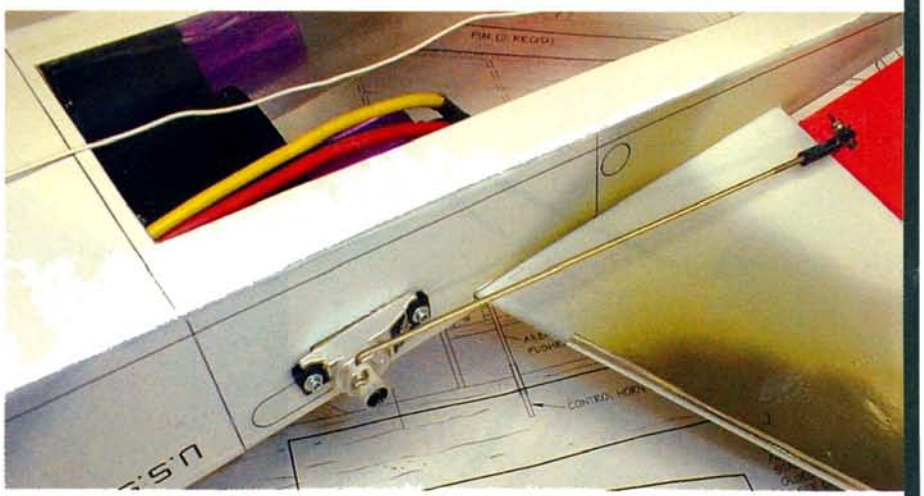
The fuselage is a basic box structure with triangular stock added to the edges to make it stronger and provide more gluing surface. Each side can be cut out of a single 3/32x4x48-inch sheet of balsa, but the splice joint shown on the plans permits the use of 36-inch-long material. Since the fuselage is a constant width from F-6 aft, you can glue formers F-6, -7, -8 and -10 to the right fuselage side. Make certain that the formers are perpendicular to the building surface. Assemble the aft fuselage section, and glue the assembly into position. Add formers F-10 and F-11; they provide the forward and rear attachment points for the ruddervator.

Glue the left fuselage side into place, and then glue F-9A to former F-9 to provide a gluing surface for the vacuum-formed inlet ramp. Pin the fuselage into place over the top view of the plans, and install the top cross-grain sheeting. Install the fan-unit mounts and the tail crosspiece (FE). Remove the fuselage from the building surface, turn it over and sheet the bottom. Note that the bottom sheeting aft of F-9 does not completely enclose the aft fuselage.

Bolt the nylon nose-gear block to former F-4, and then, with the fuselage placed upside-down over the plans, glue formers F-4 through F-1 into place. Check the fuselage alignment, and apply the forward bottom sheeting.



These notches are where the V-tail ruddervators will be installed.



Nothing complicated here—to minimize linkage lengths, the ruddervator servos are in the fuselage sides.

Build the main hatch on top of the fuselage, and then add 1/16-inch balsa sheeting to create the canopy. Remove the hatch from the fuselage, install the 1/8-inch hold-down dowel, and drill a corresponding hole in the nose block to accept the dowel. Two plastic landing-gear straps and screws secure the aft edge of the hatch.

RUDDERVATORS

Build the ruddervators flat over the plans, and then sheet them on both sides with 1/16-inch balsa. Each root end must be beveled to a 30-degree angle. Make the elevator sections out of 3/16 balsa stock and sand them to shape. Temporarily install the hinges; then insert the ruddervator into the fuselage notch and allow it to rest on top of formers F-10 and F-11 at a 30-degree angle. To provide additional gluing surface for the ruddervators, glue short lengths of balsa into place as shown in the detailed drawing section of the plans.

LANDING GEAR

Bend the main gear wires to shape, and temporarily install them in the wing using nylon gear straps and screws. The nose-gear strut should be installed so that its length matches that shown on the plans; this provides a slightly positive deck angle.

EQUIPMENT

I used a WeMoTec 90mm fan unit with a Hacker B50-9XL brushless motor to power the MiniWave. To supply juice for the motor, I chose a 5S4P Li-poly 8000mAh pack from Thunder Power. A Jeti Hacker Master 77-0-Flight ESC controls the current flow. The fuselage hatch provides complete access to the battery and nose-

Ted Ruffo holds up the second prototype MiniWave for the camera. Even standing still, it looks fast!

wheel steering servo, so installation of these components is a breeze—likewise for the receiver and ESC that are between formers F-7 and F-8. The aileron servos are in the wing panels and are connected to the receiver with a Y-harness. The two ruddervator servos are installed in the fuselage sides below the ruddervators. Short threaded rods and ball-link fittings connect the ruddervator servos to the elevator surfaces. Install the control horns and linkages to all of the control surfaces.

Cut away the sheeting forward of F-9 to accept the vacuum-formed inlet ramp. Four screws threaded into the ply FM parts hold the fan unit in place. Route the motor wires through the side of the fuselage and into the equipment bay and attach them to the ESC. That basically completes your MiniWave.

COVERING & FINISH

No doubt, as you build the MiniWave, you will imagine it airborne and sporting a color scheme that will dazzle your flying buddies. MonoKote and UltraCote coverings on the three prototypes produced similar results (Ted Ruffo built the Marines version with the sprayed-on green camo scheme). Reinstall all the equipment, check the CG, verify correct radio and motor operation and get set for the flying field.

FLYING

Flying the MiniWave shouldn't present any problems for fliers who have from medium- to high-performance sport-model experience. Using the settings shown on the plans, control response is comfortably quick and smooth. The model is easily capable of most scale-type aerobatic maneuvers—but no 3D antics, please! It is fast enough to be impressive but is able to slow down nicely for landings when there's a gentle headwind. Yaw control with the ruddervators is effective even in a slight crosswind—not as good as a conventional vertical fin but close enough. In fact, I may try deactivating the rudder function (except for nosewheel steering) and try to fly it with aileron and elevator control only.

In short, the MiniWave does everything that I had hoped it would, and I am really pleased with the result. Besides being an easy-to-build, nice-flying jet, it provides valuable experience for more scale EDF projects.

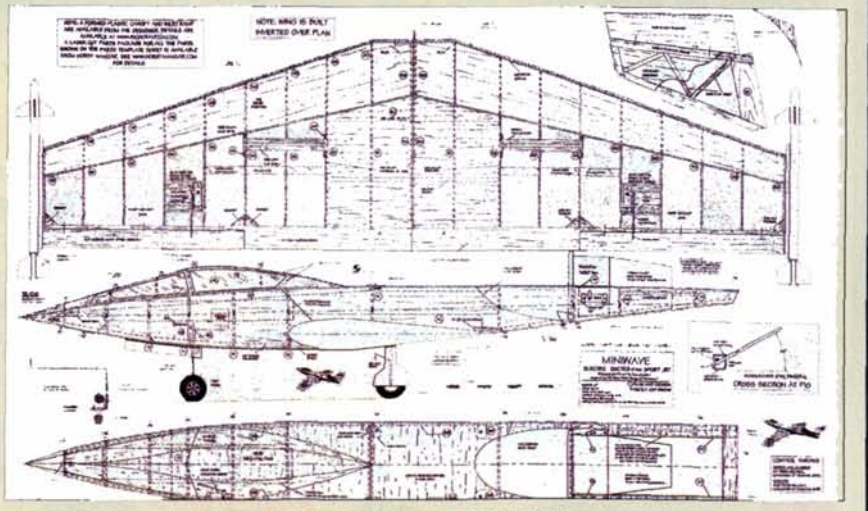
I have a plastic set that comprises the inlet ramp and a clear plastic canopy to replace the wooden parts required for the canopy shown on the plans. Please visit richuravitch.com for details. Hobby Hangar (hobbyhangar.com) also provides a laser-cut, wooden-parts package that includes all of the parts shown on the parts template sheet; check its website for additional information. ✈

COMMENTS

Designed by Rich Uravitch, this easy-to-build, electric, ducted fan is ultra-reliable and reaches flight speeds in the 100mph range. It uses traditional balsa, lite-ply and aircraft plywood construction and is finished with iron-on film covering. Plans show all of the parts required to build the model, and vacuum-formed plastic and laser-cut wooden parts are available.

See the Source Guide on page 151 for manufacturers' contact information.

FSP 0505A MINIWAVE EDF



TO ORDER THE FULL-SIZE PLAN, VISIT RCSTORE.COM ONLINE.

>SLOFLY
Prop Saver
Flexible-propeller insurance

How many times has it happened to you? You bring your model in for a landing and then, just as the plane comes to a stop, it ever so slowly tips up onto its nose—just enough to break your propeller! Argh! I hate when that happens. In a worst-case scenario, that landing could even bend the motor shaft. What's the solution? The Slofly Prop Saver!

This great little add-on costs $5 and will pay for itself the first time your airplane noses over. Machined out of aluminum, the Prop Saver fits 3mm motor shafts and comes with two attachment screws that double as the anchor points for the rubber band that holds the prop hub against the Prop Saver. The unit fits GWS 6x3 through 12x8 props. To install the Prop Saver, slide it onto the motor shaft with the step facing out, and tighten the two screws to lock it into position. Place the prop against the step, and slip the rubber band into place as shown. The rubber band holds the prop in place and automatically centers it on the shaft; the rubber band/Prop Saver combination allows the prop to "give" if it bumps against the ground! The entire unit weighs only 1 gram, including the screws. Nothing could be simpler! *—Gerry Yarrish*

Slowfly; slowfly.com.

>GLOW STARTER
Glow True
Safe, convenient starts

Now you can eliminate the clutter in your field box by having just one glow-plug igniter. The typical sub-C glow igniter will generally provide only about 15 minutes of continuous operation, but the Glow True from Fun Time Technologies will provide more than 80 minutes of continuous glow ignition. It's powered by four AA batteries. The unit's durable, fuel-resistant, plastic housing protects the key components, and it's connected to an all-steel, quick-release clip by a heavy-gauge 24-inch wire.

The Glow True provides a variety of safety and convenience features that aren't typically found on glow-plug igniters. Before attaching the Glow True to the glow plug, switch it on to check the status of its batteries. If the battery-check light comes on, then you're good to go. Then turn off the unit and connect the quick-release igniter clip to the glow plug. At this point, a continuity-check light will come on to indicate that the glow plug is good and is ready for ignition. Then turn on the Glow True, and start the engine.

When a glow igniter is removed after an ignition, the engine will sometimes quit abruptly; this often happens when an engine isn't completely broken in. With the Glow True, everything remains connected, and its power is easily turned on and off. So if the engine starts to sputter, the Glow True switch can be flipped back on to keep the engine running. Instead of having to restart the engine repeatedly (as you must do with other igniters), this allows you to fine-tune the engine until it remains running even after the Glow True is switched off. At that time, you just disconnect the igniter from the glow plug.

The Glow True is a great addition to anyone's field box and is perfect for the modeler who has everything. Although a bit pricey, with its well-made construction, it's most likely the last glow igniter you'll buy. It costs $69.99. *—John Reid*

Fun Time Technologies (260) 241-2543; funtimetechnologies.com.

>Micro Wireless
Micro Cam 2 wireless video system
Eyes from above

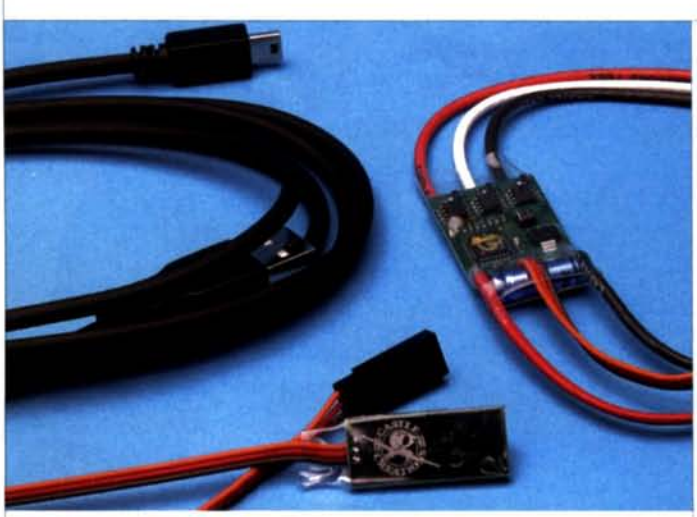
The Micro Cam 2 is a supersmall color-video system that can take aerial videos from your RC plane or helicopter. The camera features a high-resolution, 380-line color-image sensor with a 2.4GHz transmitter and an audio microphone in a package that weighs a scant ½ ounce and is only 1 square inch in size. The receiver has a four-position switch that allows you to use four cameras simultaneously. Standard RCA video/audio cables are included, so you can plug the receiver into most TVs, VCRs and camcorders. The antenna can receive signals from the camera from up to 1,000 feet from your line of sight. Besides the camera and the 4-channel receiver, the package includes an adjustable metal camera mount, AC adapters for the camera and receiver, a 9V battery cable and instructions. For great reception, high-gain antennas are also available.

To put the camera to the test, I installed it on my electric GWS Slow Stick with double-sided tape. This allowed me to move the camera around for best viewing. I also mounted the 9V battery with double-sided tape, and that took care of the airborne system. The camera's receiver can be powered by the AC power adapter or directly from a 12V power source. I used a 12V car battery during the flight tests. I also plugged the receiver into a camcorder so that I could record and watch the flights. (You need to make sure that the camcorder has an analog input; many camcorders don't.) If you use a glow-powered model or helicopter, make sure that the camera is out of the engine's exhaust stream because the oil residue will quickly foul the lens.

After a ground check, it was time to take to the skies. I tried three camera positions: straight down, straight through the prop and angled downward at 45 degrees. The camera worked very well, and the reception was great! With the camera pointing straight down, the scenery was rather two-dimensional—sort of like looking through a bombsight. When the camera was pointing through the prop, it was difficult to see things on the ground. To do so, I needed to point the nose of the model downward. Plus, as the prop was spinning, it gave the video a strobe effect. The best camera position was with it pointed 45 degrees down. It was very cool to look at the surroundings from 400 or 500 feet. Performing aerobatics with a bird's-eye view was a real hoot; it almost made me dizzy!

This $129.95 system adds excitement to your flying. Pick one up for a unique view of the world around you. *—Rick Bell*

Micro Wireless (817) 715-1989; microwireless.net.



>CASTLE CREATIONS
PHX-LINK
PC programming

Castle Creations' Phoenix line of brushless speed controls offers an outstanding array of custom settings, but programming them can take a bit of time and patience. Now you don't have to hassle with moving your transmitter sticks and waiting for beeps and flashes; just plug your Phoenix brushless ESC into the Windows-compatible PHX-LINK, and insert its 7-foot cord into a USB port on your PC! Download the user-friendly program from the Castle Creations website, and you'll easily be able to check, set up, or change your Phoenix speed control's settings.

Click on the appropriate function, and a drop-down menu allows you to select the desired settings with point-and-click ease. Customize basic ESC settings such as cutoff voltage, cut-off type, brake type, throttle type, soft start and rotation direction, or reset all settings to the defaults. You can also customize advanced ESC settings such as motor advance, current settings and PWM frequency.

The new PHX-LINK is truly a time-saving tool that's well worth its price tag of $25. You'll need a PC with Windows 98, ME, 2000, or XP, a USB port and access to the Internet so you can download the program and related updates. *—John Reid*

Castle Creations (785) 883-4519; castlecreations.com.

AT *MODEL AIRPLANE NEWS*, we not only tell you what's new, but we also try it out first so we can bring you mini-reviews of the stuff we like best. Manufacturers frequently send us their latest support equipment, and if we think a product is good—something special that will make your modeling experiences a little easier or just plain more fun—we'll let you know here. From retracts and hinges to glow starters and videotapes, look for it in "Product Watch."

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BUSINESS

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BUSINESS PARTNER(S)/COLLABORATOR. Opportunity for capable individual(s) with online sales (webmastering a plus), wholesale/distribution experiences on LiPoly (become exclusive importer), brushless, ESCs and all other related products, as we have the best sourcing in Asia. Contact: marquisvns@aol.com, (626) 793-4567. [7/05]

WANTED: UNIMAT AND WATCHMAKER LATHES; early microprocessors: KIMs; SYMs; AIMs; SOLs; robots and Atmos clocks. John Rawley, 1923 Susquehanna, Abington, PA 19001; (215) 884-9220; johnR750@aol.com. [6/05]

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QUARTER-SCALE FLEET MODEL 2 BIPLANE AND 1/6 ELECTRIC FLEET KITS. Concept Models, 6505 Urich Terrace, Madison, WI 53719. SASE for details; mailbag.com/users/conceptmodels; *(608) 848-4108.* [2/05]

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BOB'S AIRCRAFT DOCUMENTATION, NEW 2005/6. World's *largest commercial collection of aircraft photos (400,000)* and 3-view line drawings (39,000). 272-page catalog—$10; Canada, Mexico, Alaska, Hawaii & Puerto Rico—$12; international—$20 *(includes air postage).* 3114 *Yukon Ave., Costa Mesa, CA 92626;* (714) 979-8058; bobsairdoc.com. [5/05]

R/C FLIGHT INSTRUCTION in North Central Georgia Mountains "Blairsville"; (706) 745-8667. [9/05]

JETS, JETS, JETS. Ducted-fan jet kits. Fly an F-15 Regal Eagle with a .61 engine; rcjets.com. [2/05]

COMPOSITE KITS TO REPLACE BROKEN ARFs—$15 TO $65. For catalog, send two stamps to Willairco, P.O. Box 57, East Palatka, FL 32131; (386) 546-3222. [2/05]

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HOBBYIST

FREESTYLE 45 looks great, lands gently and performs superior aerobatics. Photo in December issue's "Pilot Projects." Easier self-jigging construction, rolled AutoCAD drawings, detailed building guide and materials list plus bonus drawings; only $22.95 plus $6.95 S&H. Email LLCRCAERO@yahoo.com, or call (860) 739-6846 for full description and photos. [2/05]

FOR SALE: SUPER CYCLONE (PRE-WW II) & ROCKET MOTOR ignition engines, Arden 19 glow engine, excellent fins & compression; *$275 (3). "Air News Yearbook" Vols. 1 & 2 (WW II);* best reasonable offer. Bob Cowherd Sr. (315) 655-3864 'til 9 pm Eastern time. [2/05]

FOR SALE: Top Flite 1-in. Scale P-51 Control Line. Also, Scale Master JN-40 "Jenny" 44-in. Control Line. Both kits in original boxes. (618) 566-2757. [6/05]

BACK ISSUES, MODEL MAGAZINES. 61 Coach, Glastonbury, CT 06033-3237; davidbrown46@cox.net. [3/05]

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R/C VIDEO: featuring aerial views from the pilot's seat; 1/3-scale J-3 Cub, 1/5 Beech Staggerwing and more! 90 minutes; VHS tape—$7.50; DVD-R—$10. Send check to Raymond Keel, 1200 E. Davis St., Ste. 115, Box 192, Mesquite, TX 75149. [4/05]

USED ENGINES WANTED: pre-1970 preferred. T. Crouss, 100 Smyrna, West Springfield, MA 01089-1706; (413) 732-3859. [10/05]

VINCE MILLER PLANS AVAILABLE AGAIN. Send $2 for brochure to Calvin's Classic Plans, 3704 Drumm Ave., Independence, MO 64055. [6/05]

WANTED: A COMPLETE SET OF PLANS (5 sheets) for Richard Barron's classic Boeing Stearman 96-in.-wingspan PT-13. I recently bought this model 80% completed and *want to finish building it.* Gerald L. Norway, 189 S. 2nd St., Fulton, NY 13069; (315) 593-8045. [2/05]

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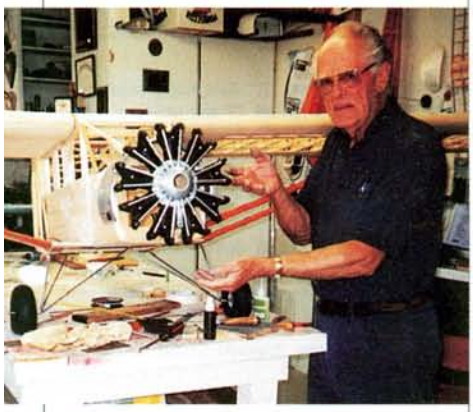
BY MOLLY O'BYRNE > PHOTOS BY GUY C. CRILLY

The full-size "Miss Veedol" and Bob Heikell's ¼-scale model strike a bright orange pose for the camera!

Spirit of Wenatchee

FULL-SIZE AND ¼-SCALE REPLICAS CELEBRATE AVIATION HISTORY

The collaborators in the Spirit of Wenatchee project (left to right): Bob Heikell, David Knannlein, Frank Wright and Gene LaFond with their ¼-scale Miss Veedol.



Bob Heikell shows off his handiwork as the model takes shape on his workbench.

WHEN STUNT FLIER EXTRAORDINAIRE Clyde "Upside Down" Pangborn belly-landed his Bellanca Model J "Miss Veedol" at the Wenatchee, WA, airfield on October 5, 1931, he probably had no idea that his record-shattering transpacific flight would be commemorated 70-plus years later by teams of hard-working builders and modelers.

Always eager for a challenge, Pangborn and his navigator, Hugh Herndon, stumbled in their attempt to beat Wiley Post in an around-the-world competition. But when a Japanese newspaper subsequently offered $25,000 to whomever made the first nonstop flight from Japan to the U.S., Pangborn jumped at the chance. A few days before takeoff, however, he had second thoughts; he feared that his fuel supply would be insufficient, so he rigged a device that would allow him to jettison his landing gear once airborne, thereby saving weight and increasing his plane's range by 600 miles. It worked—sort of; when the gear struts failed to release, the one-time barnstormer crawled out onto the wing to loosen them by hand!

Calling themselves "The Spirit of Wenatchee Committee," a dedicated team of builders spent five years constructing a full-size, flying replica of Pangborn's "Miss Veedol" that made its first flight in 2003. To help promote the project nationwide, modelers Bob Heikell, Frank Wright and David Knannlein collaborated on a ¼-scale version that took 1,500 man-hours to complete. The 150-inch-span, 41-pound model has logged nearly 170 flights and was most recently flown at the U.S. Scale Masters Championships in Gardner, KS. It's powered by a 4.75hp Zenoah G62 engine swinging a 22x8 prop, and Bob Heikell tells *Model Airplane News* that it "... has been mistaken on occasion for the 'real thing' by spectators!"

The model-building team consists of Washingtonians Heikell, a former director of the Embry-Riddle Aeronautical University; Wright, a retired sheet-metal fabricator and master craftsman; and Knannlein, a relative newcomer to modeling who provided much of the documentation. The three friends have been assisted by Wenatchee hobby-shop owner Gene LaFond, an expert in the operation of large-scale aircraft.

As Bob explains, "The modelers and the Spirit of Wenatchee group maintained close contact throughout. It is sincerely hoped that this may in some small way assist in bringing the worlds of full-scale aviation and aeromodeling closer together." Congratulations to all involved for creating such beautiful aircraft! ✈